

COOLING SYSTEM

TABLE OF CONTENTS

| | page | | page |
|--|------|---|------|
| DESCRIPTION AND OPERATION | | COOLANT LEVEL CHECK | 28 |
| COOLING SYSTEM | 2 | COOLING SYSTEM—DRAINING AND FILLING | 28 |
| COOLANT RESERVE/OVERFLOW SYSTEM | 5 | COOLING SYSTEM—CLEANING/REVERSE FLUSHING | 29 |
| ENGINE ACCESSORY DRIVE BELTS | 5 | COOLANT | 30 |
| RADIATOR | 5 | COOLANT SELECTION AND ADDITIVES | 30 |
| WATER PUMP | 6 | REMOVAL AND INSTALLATION | |
| WATER PUMP BYPASS—4.7L | 6 | COOLANT RESERVE/OVERFLOW TANK | 30 |
| WATER PUMP BYPASS—3.9/5.9L ENGINES | 6 | WATER PUMP—2.5L ENGINE | 30 |
| THERMOSTAT—3.9L/5.9L ENGINES | 7 | WATER PUMP—3.9L/5.9L ENGINES | 32 |
| THERMOSTAT—4.7L ENGINE | 7 | WATER PUMP 4.7L ENGINES | 35 |
| AUTOMATIC TRANSMISSION OIL COOLERS | 8 | WATER PUMP BYPASS HOSE—3.9/5.9L ENGINES | 37 |
| AUTOMATIC BELT TENSIONER | 8 | THERMOSTAT—3.9L/5.9L ENGINES | 39 |
| BLOCK HEATER | 9 | THERMOSTAT—2.5L ENGINE | 42 |
| RADIATOR PRESSURE CAP | 10 | THERMOSTAT—4.7L ENGINE | 43 |
| HOSE CLAMPS | 10 | TRANSMISSION OIL COOLER LINES | 44 |
| VISCOUS FAN DRIVE | 11 | RADIATOR | 44 |
| COOLING SYSTEM FAN | 11 | ENGINE BLOCK HEATER | 46 |
| DIAGNOSIS AND TESTING | | ACCESSORY DRIVE BELT—2.5L ENGINE | 47 |
| ON-BOARD DIAGNOSTICS (OBD) | 12 | ACCESSORY BELT REPLACEMENT—4.7L ENGINE | 48 |
| DRB SCAN TOOL | 13 | ACCESSORY DRIVE BELT—3.9L/5.9L ENGINES | 49 |
| WATER PUMP TESTS | 13 | ACCESSORY DRIVE BELT TENSIONER—2.5L | 50 |
| PRELIMINARY CHECKS | 14 | AUTOMATIC BELT TENSIONER 3.9L/5.9L ENGINES | 50 |
| COOLING SYSTEM | 15 | AUTOMATIC BELT TENSIONER—4.7L ENGINE | 51 |
| ELECTRIC COOLING FAN | 20 | IDLER PULLEY—2.5L/3.9L/5.9L ENGINES | 51 |
| RADIATOR COOLANT FLOW CHECK | 21 | IDLER PULLEY—4.7L ENGINE NON A/C | 52 |
| COOLING SYSTEM—TESTING FOR LEAKS | 21 | RADIATOR DRAINCOCK | 52 |
| VISCOUS FAN DRIVE—3.9L/4.7L and 5.9L ENGINES | 23 | VISCOUS FAN DRIVE | 53 |
| ACCESSORY DRIVE BELT DIAGNOSIS | 24 | ELECTRIC FAN | 54 |
| THERMOSTAT | 26 | CLEANING AND INSPECTION | |
| RADIATOR CAP-TO-FILLER NECK SEAL—PRESSURE RELIEF CHECK | 26 | RADIATOR CAP | 55 |
| RADIATOR CAP—PRESSURE TESTING | 26 | RADIATOR | 55 |
| COOLANT—LOW LEVEL AERATION | 27 | WATER PUMP | 55 |
| COOLING SYSTEM—DEAERATION | 27 | | |
| SERVICE PROCEDURES | | | |
| COOLANT—ROUTINE LEVEL CHECK | 27 | | |
| COOLANT SERVICE | 27 | | |
| COOLANT—ADDING ADDITIONAL | 28 | | |

| | |
|---|----|
| FAN BLADE..... | 55 |
| SPECIFICATIONS | |
| COOLING SYSTEM CAPACITIES..... | 56 |
| ACCESSORY DRIVE BELT TENSION—2.5L ENGINE | 56 |

| | |
|----------------------------|----|
| TORQUE SPECIFICATIONS..... | 56 |
| SPECIAL TOOLS | |
| COOLING | 57 |

DESCRIPTION AND OPERATION

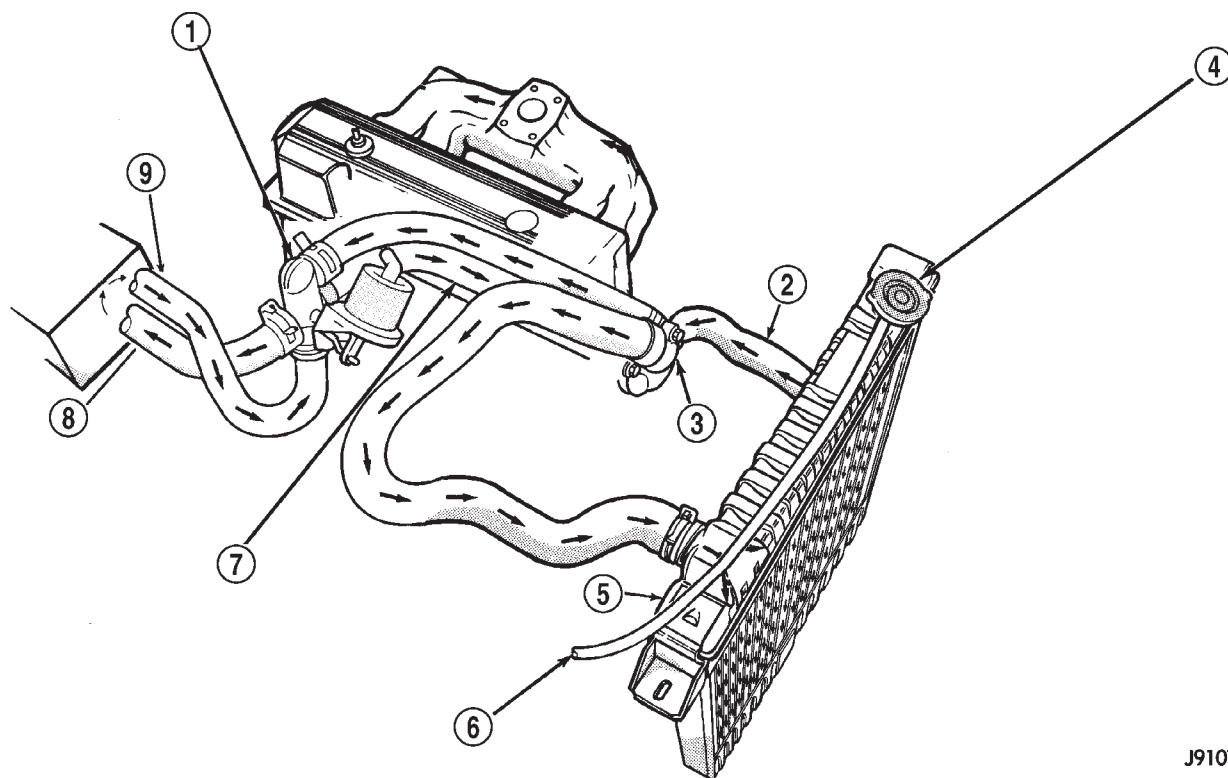
COOLING SYSTEM

DESCRIPTION

The cooling system regulates engine operating temperature. It allows the engine to reach normal operating temperature as quickly as possible. It also

maintains normal operating temperature and prevents overheating.

The cooling system also provides a means of heating the passenger compartment and cooling the automatic transmission fluid (if equipped). The cooling system is pressurized and uses a centrifugal water pump to circulate coolant throughout the system.



J9107-34

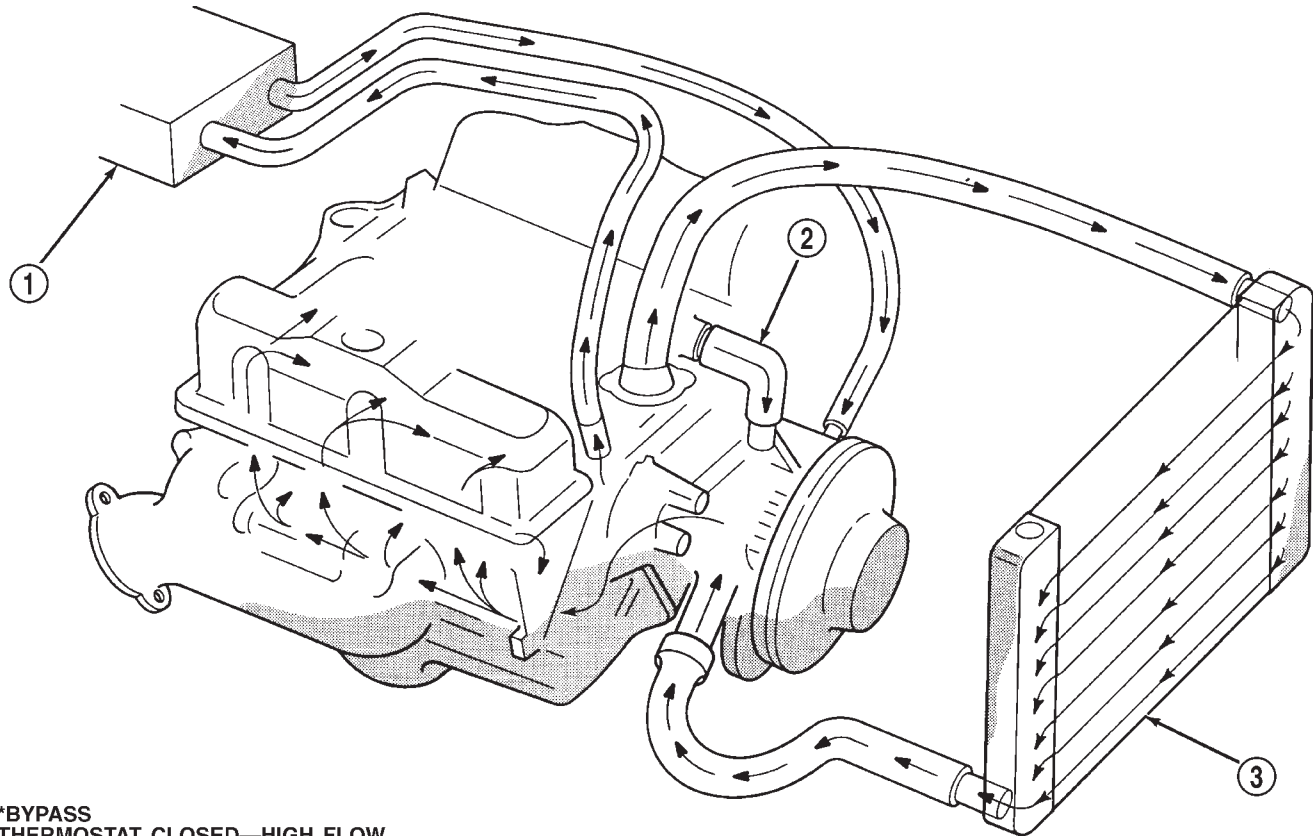
Fig. 1 Engine Cooling System Flow—2.5L Engine—Typical

- 1 - WATER CONTROL VALVE
- 2 - TO WATER PUMP
- 3 - THERMOSTAT HOUSING
- 4 - RADIATOR CAP
- 5 - RADIATOR

- 6 - TO COOLANT RESERVE BOTTLE
- 7 - TO WATER PUMP
- 8 - TO HEATER CORE
- 9 - FROM HEATER CORE

DESCRIPTION AND OPERATION (Continued)

An optional factory installed maximum duty cooling package is available on most models. This package will provide additional cooling capacity for vehicles used under extreme conditions such as trailer towing in high ambient temperatures.



*BYPASS
THERMOSTAT CLOSED—HIGH FLOW
THERMOSTAT OPEN—LOW FLOW

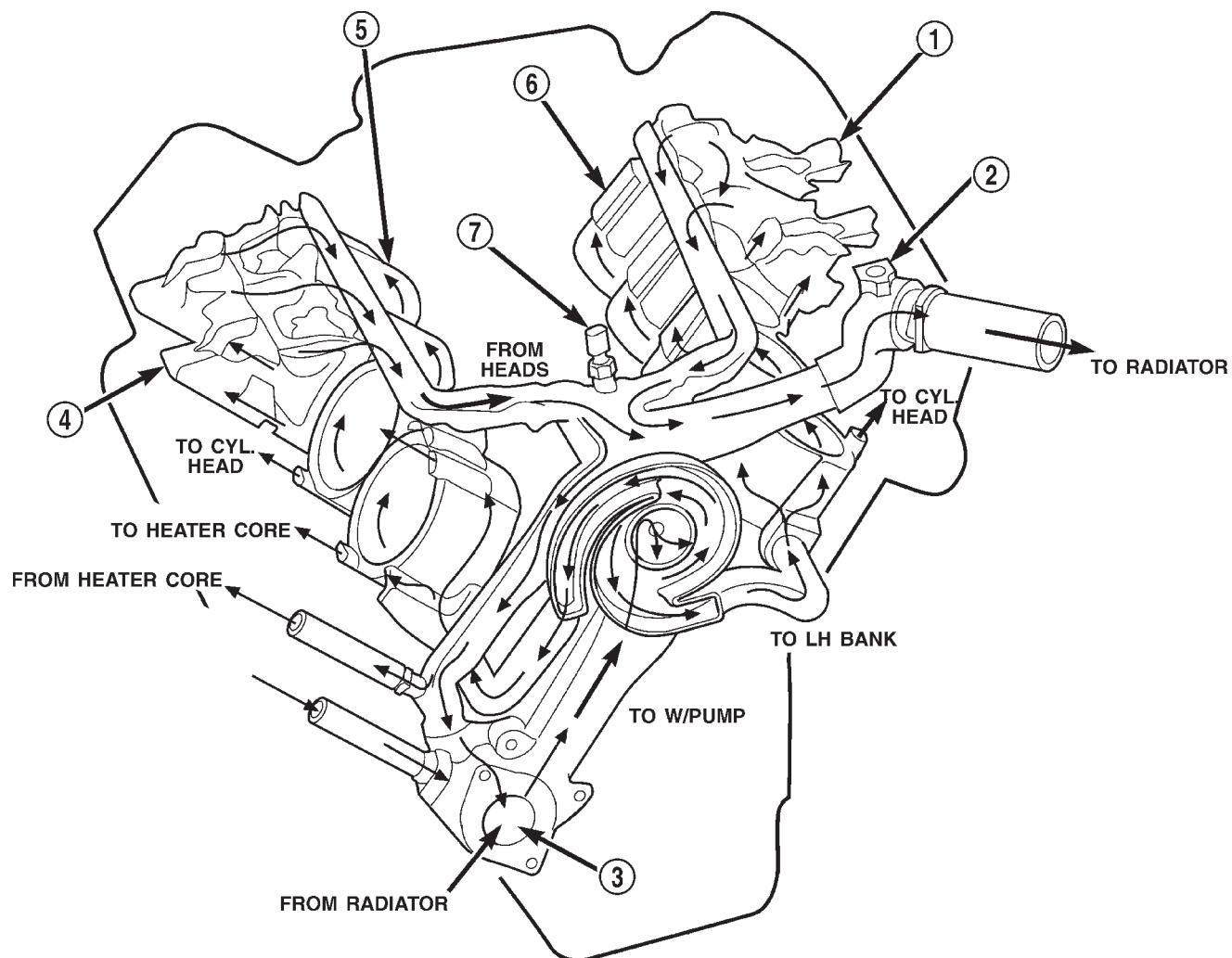
J9407-1

Fig. 2 Engine Cooling System Flow—3.9L/5.9L Engines—Typical

1 - HEATER
2 - BYPASS*

3 - CROSSFLOW RADIATOR

DESCRIPTION AND OPERATION (Continued)



80b46c07

Fig. 3 Engine Cooling System Flow—4.7L Engine—Typical

1 - LH CYL. HEAD

2 - BLEED

3 - THERMOSTAT LOCATION

4 - RH CYL. HEAD

5 - RH BANK CYL. BLOCK

6 - LH BANK CYL. BLOCK

7 - COOLANT TEMP. SENSOR

DESCRIPTION AND OPERATION (Continued)

COOLANT RESERVE/OVERFLOW SYSTEM

DESCRIPTION

The coolant reserve/overflow tank is integral to the upper fan shroud assembly and is made of high temperature plastic.

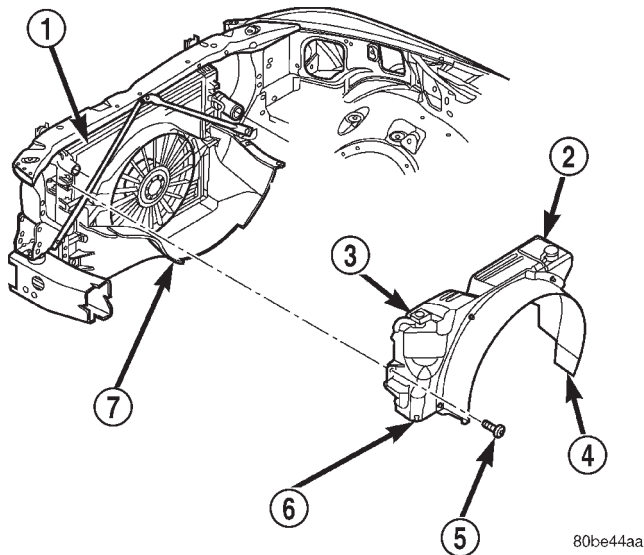


Fig. 4 Upper Fan Shroud with Integral Coolant Reserve/Overflow System

- 1 – RADIATOR
- 2 – WASHER FLUID RESERVOIR
- 3 – COOLANT OVERFLOW/RESERVOIR
- 4 – FAN SHROUD (UPPER)
- 5 – SCREW
- 6 – INTERLOCKING PINS
- 7 – FAN SHROUD (LOWER)

OPERATION

The coolant reserve/overflow system works in conjunction with the radiator pressure cap. It utilizes thermal expansion and contraction of coolant to keep coolant free of trapped air. It provides a volume for expansion and contraction of coolant. It also provides a convenient and safe method for checking coolant level and adjusting level at atmospheric pressure. This is done without removing the radiator pressure cap. The system also provides some reserve coolant to the radiator to cover minor leaks and evaporation or boiling losses.

As the engine cools, a vacuum is formed in the cooling system of both the radiator and engine. Coolant will then be drawn from the coolant tank and returned to a proper level in the radiator.

ENGINE ACCESSORY DRIVE BELTS

DESCRIPTION

CAUTION: When installing a serpentine accessory drive belt, the belt **MUST** be routed correctly. If not, the engine may overheat due to water pump rotating in wrong direction. Refer to the appropriate engine Belt Schematic in this Section for the correct belt routing. Or, refer to the Belt Routing Label located in the engine compartment.

The accessory drive belt is made of rubber and has grooves in only one side, these grooves mate to the grooves in the accessories pulleys for maximum belt contact and belt alignment.

The accessory drive components are operated by a single, crankshaft driven, serpentine drive belt on all engines. An automatic belt tensioner is also used to maintain correct belt tension at all times.

RADIATOR

DESCRIPTION

The radiator is a aluminum cross-flow design with horizontal tubes through the radiator core and vertical plastic side tanks.

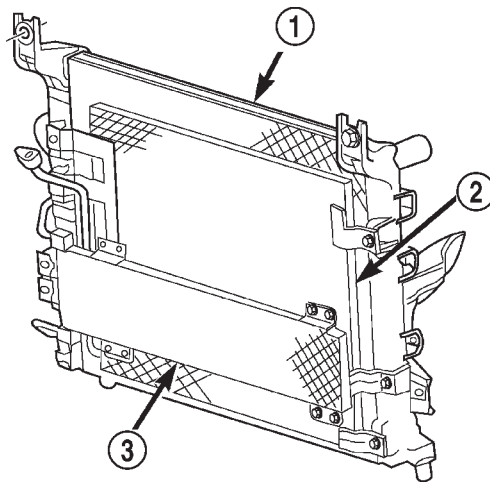


Fig. 5 Radiator—Typical

- 1 – RADIATOR
- 2 – A/C CONDENSER (IF EQUIPPED)
- 3 – TRANSMISSION AUXILIARY OIL COOLER

OPERATION

The radiator supplies sufficient heat transfer using the cooling fins interlaced between the horizontal tubes in the radiator core to cool the engine and automatic transmission oil (if equipped).

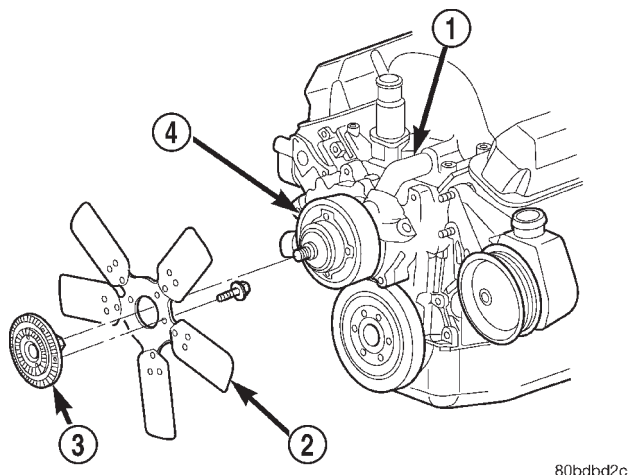
DESCRIPTION AND OPERATION (Continued)

WATER PUMP

DESCRIPTION

The water pump is located on the engine front cover, and has an integral pulley attached (Fig. 6).

The water pump impeller is pressed onto the rear of a shaft that rotates in a bearing pressed into the water pump body. The body has a small hole for ventilation. The water pump seals are lubricated by antifreeze in the coolant mixture. Additional lubrication is not necessary.



80bdbd2c

Fig. 6 Water Pump Location—Typical

- 1 - WATER PUMP BYPASS HOSE
- 2 - FAN BLADE ASSEMBLY
- 3 - VISCOUS FAN DRIVE
- 4 - WATER PUMP AND PULLEY

OPERATION

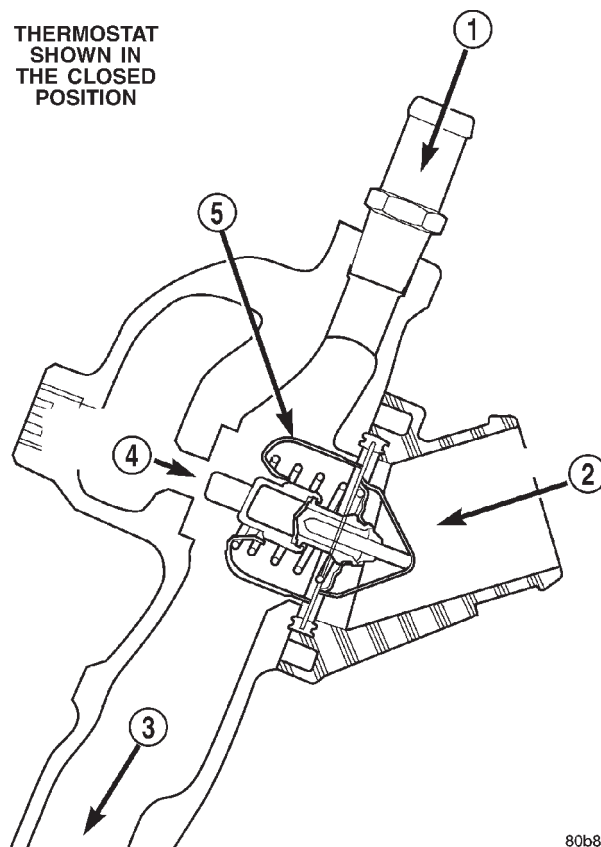
A centrifugal water pump circulates coolant through the water jackets, passages, intake manifold, radiator core, cooling system hoses and heater core, this coolant absorbs the heat generated when the engine is running. The pump is driven by the engine crankshaft via a drive belt.

WATER PUMP BYPASS—4.7L

DESCRIPTION

The 4.7L engine uses an internal water/coolant bypass system. The design uses galleries in the timing chain cover to circulate coolant during engine warm-up preventing the coolant from flowing through the radiator. The thermostat uses a stub shaft located at the rear of the thermostat (Fig. 7) to control flow through the bypass gallery.

THERMOSTAT
SHOWN IN
THE CLOSED
POSITION



80b897e4

Fig. 7 Water/Coolant Bypass Flow and Thermostat—4.7L Engine

- 1 - FROM HEATER
- 2 - FROM RADIATOR
- 3 - TO WATER PUMP
- 4 - ENGINE BYPASS
- 5 - THERMOSTAT

OPERATION

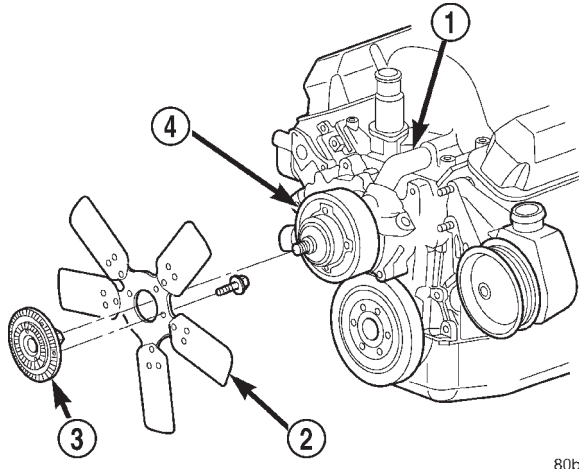
When the thermostat is in the closed position the bypass gallery is not obstructed allowing 100% flow. When the thermostat is in the open position the stub shaft enters the bypass gallery obstructing bypass coolant flow by 50%. This design allows the coolant to reach operating temperature quickly when cold, while adding extra cooling during normal temperature operation.

WATER PUMP BYPASS—3.9/5.9L ENGINES

DESCRIPTION

A rubber water pump bypass hose (Fig. 8) is used between the intake manifold and water pump on all 3.9/5.9L engines.

DESCRIPTION AND OPERATION (Continued)



80bdbd2c

Fig. 8 Water Pump Bypass Hose—3.9L/5.9L Engines

- 1 - WATER PUMP BYPASS HOSE
- 2 - FAN BLADE ASSEMBLY
- 3 - VISCOUS FAN DRIVE
- 4 - WATER PUMP AND PULLEY

OPERATION

When the thermostat is in the closed position the bypass hose allows the water pump to circulate the engine coolant through the cylinder block while at the same time preventing the coolant from flowing through the radiator, this allows the coolant to heat up quicker thus bring the engine to operating temperature faster.

THERMOSTAT—3.9L/5.9L ENGINES**DESCRIPTION**

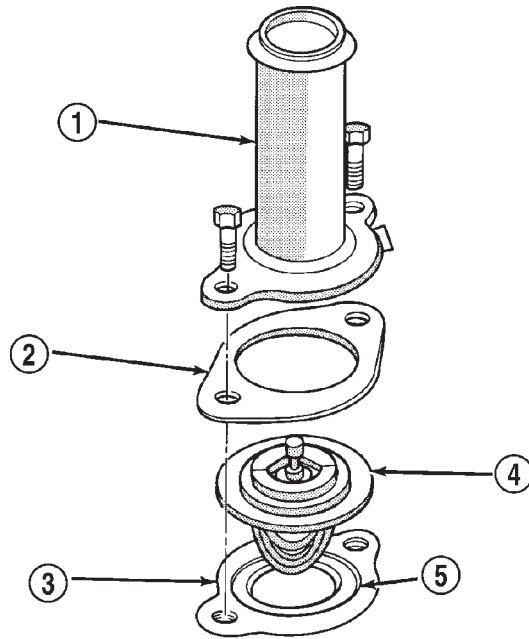
CAUTION: Do not operate an engine without a thermostat, except for servicing or testing.

The thermostat on all gas powered engines is located beneath the thermostat housing at the front of the intake manifold (Fig. 9).

The thermostat is a wax pellet driven, reverse poppet choke type.

Coolant leakage into the pellet container will cause the thermostat to fail in the open position. Thermostats very rarely stick. Do not attempt to free a thermostat with a prying device.

The same thermostat is used for winter and summer seasons. An engine should not be operated without a thermostat, except for servicing or testing. Operating without a thermostat causes longer engine warmup time, unreliable warmup performance, increased exhaust emissions and crankcase condensation that can result in sludge formation.



J9207-14

Fig. 9 Thermostat—3.9L V-6 or 5.9L V-8 Gas Powered Engines

- 1 - THERMOSTAT HOUSING
- 2 - GASKET
- 3 - INTAKE MANIFOLD
- 4 - THERMOSTAT
- 5 - MACHINED GROOVE

OPERATION

The wax pellet is located in a sealed container at the spring end of the thermostat. When heated, the pellet expands, overcoming closing spring tension and water pump pressure to force the valve to open.

THERMOSTAT—4.7L ENGINE**DESCRIPTION**

CAUTION: Do not operate an engine without a thermostat, except for servicing or testing.

A pellet-type thermostat controls the operating temperature of the engine by controlling the amount of coolant flow to the radiator. On all engines the thermostat is closed below 195°F (90°C). Above this temperature, coolant is allowed to flow to the radiator. This provides quick engine warm up and overall temperature control. On the 4.7L engine the thermostat is designed to block the flow of the coolant bypass journal by 50% instead of completely blocking the flow. This design controls coolant temperature more accurately (Fig. 10).

The same thermostat is used for winter and summer seasons. An engine should not be operated without a thermostat, except for servicing or testing.

DESCRIPTION AND OPERATION (Continued)

Operating without a thermostat causes other problems. These are: longer engine warmup time, unreliable warmup performance, increased exhaust emissions and crankcase condensation. This condensation can result in sludge formation.

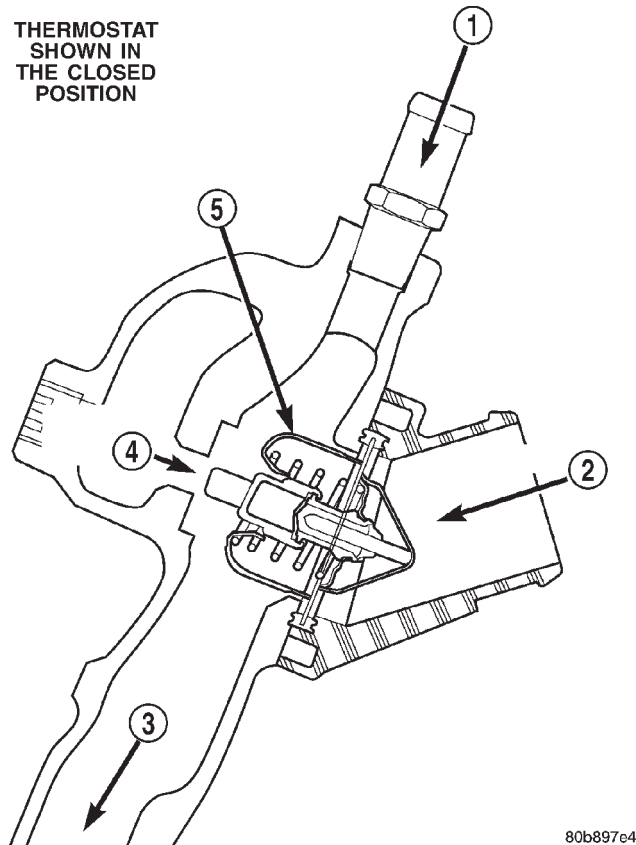


Fig. 10 Thermostat Cross Section View 4.7L

- 1 - FROM HEATER
- 2 - FROM RADIATOR
- 3 - TO WATER PUMP
- 4 - ENGINE BYPASS
- 5 - THERMOSTAT

OPERATION

The wax pellet is located in a sealed container at the spring end of the thermostat. When heated, the pellet expands, overcoming closing spring tension and water pump pressure to force the valve to open.

AUTOMATIC TRANSMISSION OIL COOLERS

DESCRIPTION

CAUTION: On in-radiator type oil coolers, if transmission oil cooler is leaking, engine coolant may enter cooler, or transmission oil may enter engine cooling system. Both engine cooling system and transmission oil circuit should be drained, flushed, and inspected.

There are two types of transmission oil coolers used. One type of cooler is the in-radiator type or oil to coolant type. This type oil cooler is not serviceable. The second type used is a remote type auxiliary oil cooler or oil to air cooler. The oil to air type cooler is located in front of the radiator, and is serviceable.

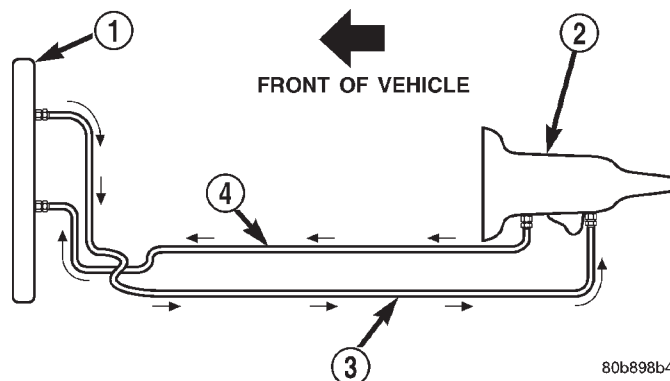


Fig. 11 Oil Flow to Cooler—Top View (Typical)

- 1 - TRANSMISSION OIL COOLER
- 2 - AUTOMATIC TRANSMISSION
- 3 - RETURN LINE
- 4 - PRESSURE LINE

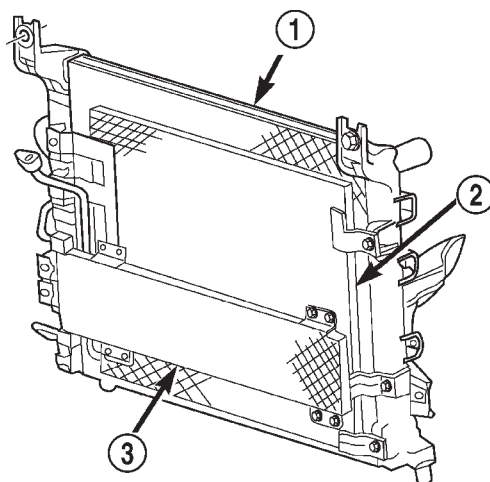


Fig. 12 Auxiliary Transmission Oil Cooler—Typical

- 1 - RADIATOR
- 2 - A/C CONDENSER (IF EQUIPPED)
- 3 - TRANSMISSION AUXILIARY OIL COOLER

AUTOMATIC BELT TENSIONER

DESCRIPTION

Correct drive belt tension is required to ensure optimum performance of the belt driven engine accessories. If specified tension is not maintained, belt slippage may cause; engine overheating, lack of power steering assist, loss of air conditioning capacity, reduced generator output rate, and greatly reduced belt life.

DESCRIPTION AND OPERATION (Continued)

It is not necessary to adjust belt tension on the 3.9L, 4.7L or 5.9L engines. These engines are equipped with an automatic belt tensioner (Fig. 13) (Fig. 14). The tensioner maintains correct belt tension at all times. Due to use of this belt tensioner, do not attempt to use a belt tension gauge on 3.9L, 4.7L or 5.9L engines.

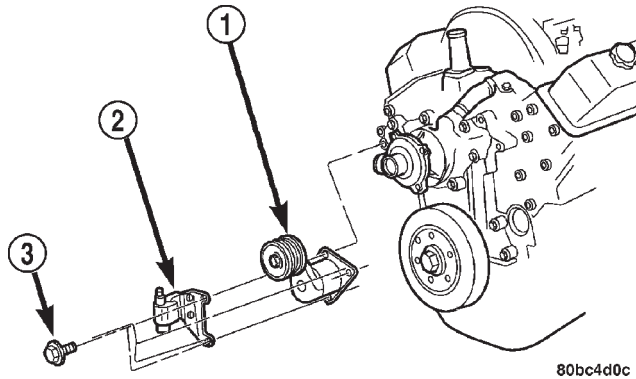


Fig. 13 Automatic Belt Tensioner—3.9L and 5.9L Engines

- 1 – AUTOMATIC TENSIONER
- 2 – COIL AND BRACKET
- 3 – SCREW AND WASHER

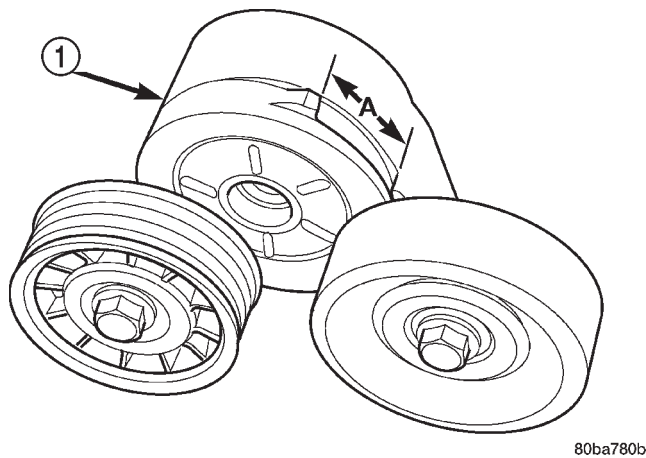


Fig. 14 Automatic Belt Tensioner—4.7L Engine

- 1 – AUTOMATIC TENSIONER ASSEMBLY

OPERATION

The automatic belt tensioner maintains belt tension by using internal spring pressure, a pivoting arm and pulley to press against the drive belt.

BLOCK HEATER

DESCRIPTION

WARNING: DO NOT OPERATE ENGINE UNLESS BLOCK HEATER CORD HAS BEEN DISCONNECTED FROM POWER SOURCE AND SECURED IN PLACE. THE POWER CORD MUST BE SECURED IN ITS RETAINING CLIPS AND ROUTED AWAY FROM EXHAUST MANIFOLDS AND MOVING PARTS.

An optional engine block heater is available for all models. The heater is equipped with a power cord. The cord is attached to an engine compartment component with tie-straps. The heater is mounted in a core hole of the engine cylinder block in place of a freeze plug with the heating element immersed in engine coolant.

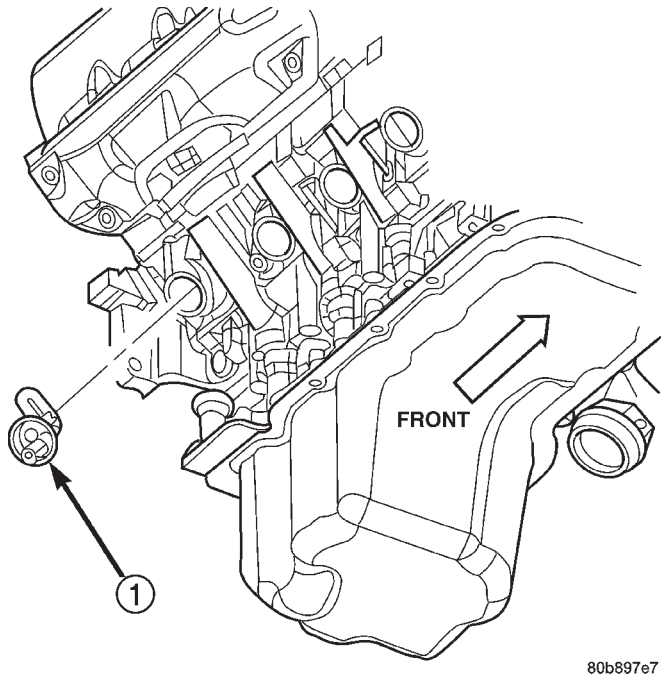


Fig. 15 Block Heater—4.7L

- 1 – ENGINE BLOCK HEATER

OPERATION

The heater warms the engine providing easier engine starting and faster warm-up in low temperatures. The power cord must be connected to a grounded 110-120 volt AC electrical outlet with a grounded, three wire extension cord, this provides the electricity to warm the heating element.

DESCRIPTION AND OPERATION (Continued)

RADIATOR PRESSURE CAP

DESCRIPTION

All radiators are equipped with a pressure cap. This cap releases pressure at some point within a range of 124-to-145 kPa (18-to-21 psi). The pressure relief point (in pounds) is engraved on top of the cap.

The cooling system will operate at pressures slightly above atmospheric pressure. This results in a higher coolant boiling point allowing increased radiator cooling capacity. The cap contains a spring-loaded pressure relief valve. This valve opens when system pressure reaches the release range of 124-to-145 kPa (18-to-21 psi).

A rubber gasket seals the radiator filler neck. This is done to maintain vacuum during coolant cool-down and to prevent leakage when system is under pressure.

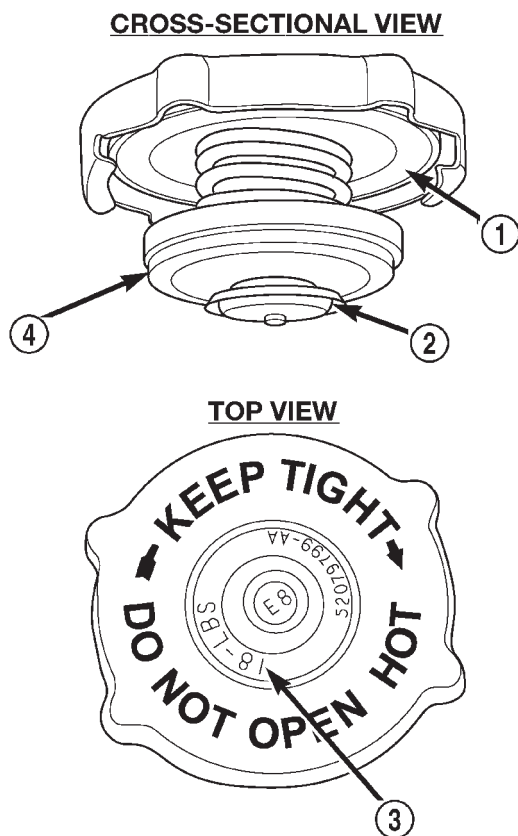


Fig. 16 Radiator Pressure Cap—Typical

- 1 - FILLER NECK SEAL
- 2 - VACUUM VENT VALVE
- 3 - PRESSURE RATING
- 4 - PRESSURE VALVE

OPERATION

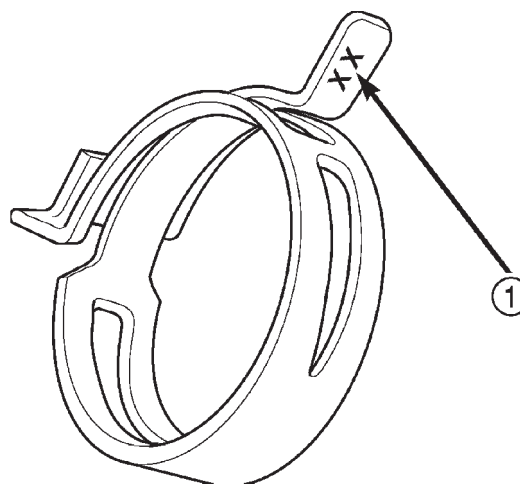
A vent valve in the center of the cap will remain shut as long as the cooling system is pressurized. As the coolant cools, it contracts and creates a vacuum in cooling system. This causes the vacuum valve to open and coolant in reserve/overflow tank to be drawn through connecting hose into radiator. If the vacuum valve is stuck shut, or overflow hose is kinked, radiator hoses will collapse on cool-down.

HOSE CLAMPS

DESCRIPTION

The cooling system utilizes both worm drive and spring type hose clamps. If a spring type clamp replacement is necessary, replace with the original Mopar® equipment spring type clamp.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps. If replacement is necessary, use only a original equipment clamp with matching number or letter (Fig. 17).



80b76ee

Fig. 17 Spring Clamp Size Location

1 - SPRING CLAMP SIZE LOCATION

OPERATION

The worm type hose clamp uses a specified torque value to maintain proper tension on a hose connection.

The spring type hose clamp applies constant tension on a hose connection. To remove a spring type hose clamp, only use constant tension clamp pliers designed to compress the hose clamp.

80bc4e65

DESCRIPTION AND OPERATION (Continued)

VISCOUS FAN DRIVE

DESCRIPTION

CAUTION: Engines equipped with accessory drive belts have reverse rotating fans and viscous fan drives. They are marked with the word **REVERSE** to designate their usage. Installation of the wrong fan or viscous fan drive can result in engine overheating.

The thermal viscous fan drive is a silicone-fluid-filled coupling used to connect the fan blades to the water pump shaft. The coupling allows the fan to be driven in a normal manner. This is done at low engine speeds while limiting the top speed of the fan to a predetermined maximum level at higher engine speeds.

On all 3.9L, 5.9L and 4.7L an electrical cooling fan located in the fan shroud aids in low speed cooling. It is designed to augment the viscous fan. However, it does not replace the viscous fan.

A thermostatic bimetallic spring coil is located on the front face of the viscous fan drive unit. This spring coil reacts to the temperature of the radiator discharge air. It engages the viscous fan drive for higher fan speed if the air temperature from the radiator rises above a certain point. Until additional engine cooling is necessary, the fan will remain at a reduced rpm regardless of engine speed.

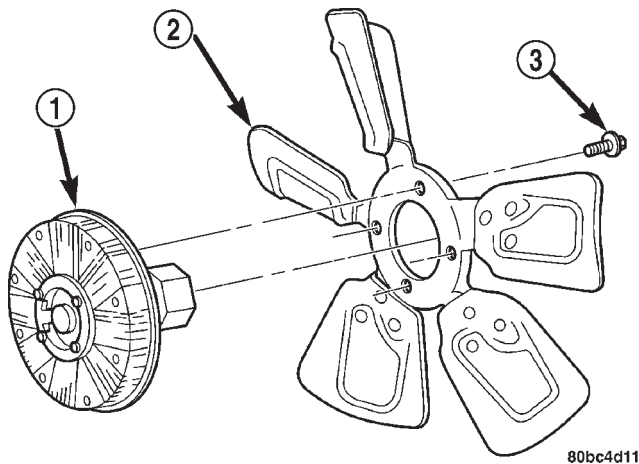


Fig. 18 Fan Blade/Viscous Fan Drive—3.9L/4.7L/5.9L Engines

- 1 - VISCOUS FAN DRIVE
- 2 - FAN BLADE
- 3 - SCREW AND WASHER

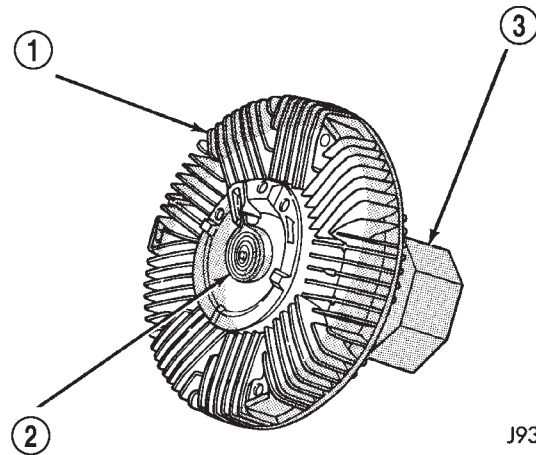


Fig. 19 Viscous Fan Drive—3.9L/4.7L/5.9L Engines—Typical

- 1 - VISCOUS FAN DRIVE
- 2 - THERMOSTATIC SPRING
- 3 - MOUNTING NUT TO WATER PUMP HUB

OPERATION

When sufficient heat is present, the viscous fan drive will engage. This is when the air flowing through the radiator core causes a reaction to the bimetallic coil. It then increases fan speed to provide the necessary additional engine cooling.

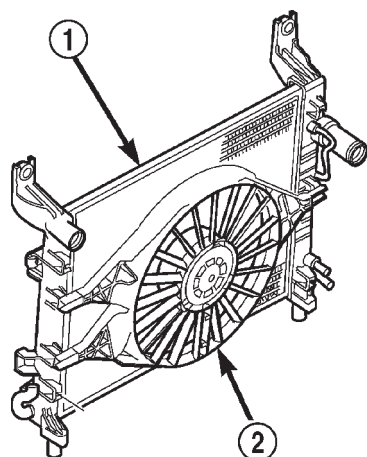
Once the engine has cooled, the radiator discharge temperature will drop. The bimetallic coil again reacts and the fan speed is reduced to the previous disengaged speed.

COOLING SYSTEM FAN

DESCRIPTION

The fan is electrically controlled by the powertrain control module (PCM) through the fan control relay. This relay is located in the power distribution center (PDC). For the location of the relay within the PDC, refer to label on PDC cover.

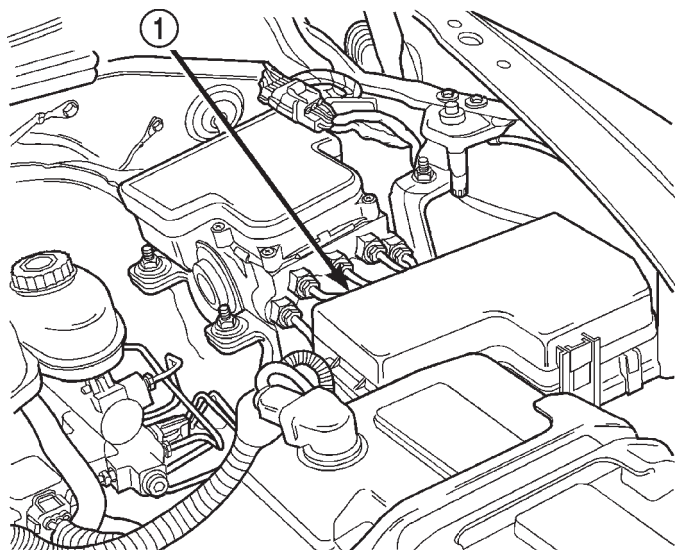
DESCRIPTION AND OPERATION (Continued)



80bdbc2d

Fig. 20 Electric Fan Assembly—Typical

- 1 - RADIATOR
2 - ELECTRIC FAN ASSEMBLY



80a7aec4

Fig. 21 Power Distribution Center (PDC)

- 1 - POWER DISTRIBUTION CENTER (PDC)

OPERATION

The PCM regulates fan operation based on input from the engine coolant temperature sensor and vehicle speed.

The fan is not energized during engine cranking regardless of the electrical input from the engine coolant temperature sensor. However, if engine operating conditions warrant fan engagement, the fan will run once engine starts.

The fan is energized whenever the engine is running and the air conditioning is selected on the temperature control panel.

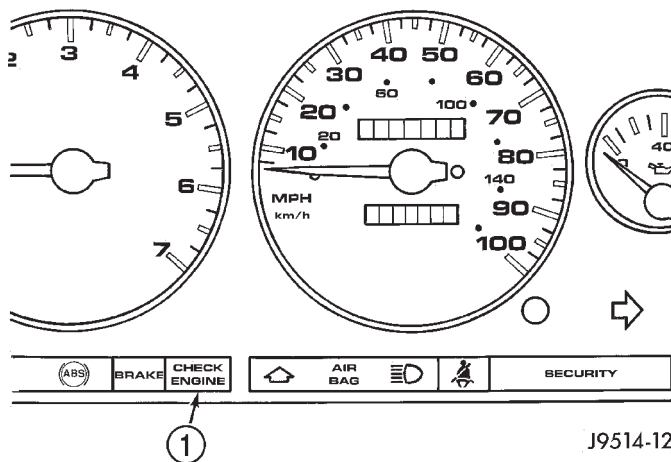
If the A/C is not selected the fan operates when the coolant temperature is above 104° C (220° F). The same is true for vehicles not equipped with A/C. The

fan will turn off when coolant temperature drops to 102° C (216° F).

DIAGNOSIS AND TESTING**ON-BOARD DIAGNOSTICS (OBD)****FOR CERTAIN COOLING SYSTEM COMPONENTS**

The powertrain control module (PCM) has been programmed to monitor certain cooling system components:

NOTE: If the engine has remained cool for too long a period, such as with a stuck open thermostat, a Diagnostic Trouble Code (DTC) number 17 can be observed at the malfunction indicator lamp. This lamp is displayed on the instrument panel as the **CHECK ENGINE** lamp (Fig. 22).



J9514-12

Fig. 22 Check Engine Lamp Location

- 1 - CHECK ENGINE LAMP

If the problem is sensed in a monitored circuit often enough to indicate an actual problem, a DTC is stored. The DTC will be stored in the PCM memory for eventual display to the service technician. If the problem is repaired or ceases to exist, the PCM cancels the DTC after 51 engine starts.

Certain criteria must be met for a DTC to be entered into PCM memory. The criteria may be a specific range of engine rpm, engine temperature and/or input voltage to the PCM.

A DTC indicates that the PCM has recognized an abnormal signal in a circuit or the system. A DTC may indicate the result of a failure, but never identify the failed component directly.

It is possible that a DTC for a monitored circuit may not be entered into memory even though a malfunction has occurred. Refer to On-Board Diagnos-

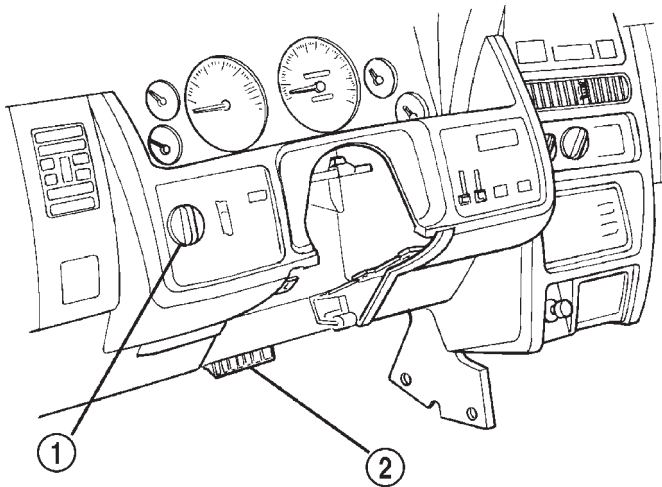
DIAGNOSIS AND TESTING (Continued)

tics (OBD) in Group 25, Emission Control Systems for additional information.

ACCESSING DIAGNOSTIC TROUBLE CODES

A stored Diagnostic Trouble Code (DTC) can be displayed by cycling the ignition key On-Off-On-Off-On within three seconds and observing the malfunction indicator lamp. This lamp is displayed on the instrument panel as the CHECK ENGINE lamp (Fig. 22).

They can also be displayed through the use of the Diagnostic Readout Box (DRB) scan tool. The DRB connects to the data link connector, left of the steering column above the brake pedal (Fig. 23). For operation of the DRB, refer to the appropriate Powertrain Diagnostic Procedures service manual.



80a07536

Fig. 23 Data Link Connector Location

- 1 - HEADLAMP SWITCH
- 2 - DATA LINK CONNECTOR (LEFT SIDE OF COLUMN ABOVE BRAKE PEDAL)

EXAMPLES:

- If the lamp (Fig. 22) flashes 1 time, pauses and flashes 2 more times, a flashing Diagnostic Trouble Code (DTC) number 12 is indicated. If this code is observed, it is indicating that the battery has been disconnected within the last 50 key-on cycles. It could also indicate that battery voltage has been disconnected to the PCM. In either case, other DTC's may have been erased.

- If the lamp flashes 1 time, pauses and flashes 7 more times, a flashing Diagnostic Trouble Code (DTC) number 17 is indicated.

After any stored DTC information has been observed, the display will end with a flashing DTC number 55. This will indicate the end of all stored information.

ERASING TROUBLE CODES

After the problem has been repaired, use the DRB scan tool to erase a DTC. Refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool.

DRB SCAN TOOL

For operation of the DRB scan tool, refer to the appropriate Powertrain Diagnostic Procedures service manual.

WATER PUMP TESTS

LOOSE IMPELLER—4.7L

NOTE: Due to the design of the 4.7L engine water pump, testing the pump for a loose impeller must be done by verifying coolant flow in the radiator. To accomplish this refer to the following procedure.

DO NOT WASTE reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

- (1) Drain coolant until the first row of cores is visible in the radiator.
- (2) Leaving the radiator cap off, start the engine
- (3) While looking into the radiator through the radiator fill neck, raise engine rpm to 2000 RPM. Observe the flow of coolant from the first row of cores.
- (4) If there is no flow or very little flow visible, replace the water pump.

INSPECTING FOR INLET RESTRICTIONS

Inadequate heater performance may be caused by a metal casting restriction in the heater hose inlet.

DO NOT WASTE reusable coolant. If solution is clean, drain the coolant into a clean container for reuse.

WARNING: DO NOT LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

- (1) Drain sufficient coolant from the radiator to decrease the level below the heater hose inlet. On 4.7L engines this requires complete draining.
- (2) Remove the heater hose.
- (3) Inspect the inlet for metal casting flash or other restrictions.

NOTE: On 4.7L engine remove the fitting from the timing chain cover, If the restriction is in the timing chain cover, remove the timing chain cover. Refer to Timing Chain Cover in Group 9 Engine, for procedure.

DIAGNOSIS AND TESTING (Continued)

PRELIMINARY CHECKS**ENGINE COOLING SYSTEM OVERHEATING**

Establish what driving conditions caused the complaint. Abnormal loads on the cooling system such as the following may be the cause:

PROLONGED IDLE, VERY HIGH AMBIENT TEMPERATURE, SLIGHT TAIL WIND AT IDLE, SLOW TRAFFIC, TRAFFIC JAMS, HIGH SPEED, OR STEEP GRADES.

Driving techniques that avoid overheating are:

- Idle with A/C off when temperature gauge is at end of normal range.
- If vehicle is equipped with a 2.5L 4-cylinder engine, do not increase engine speed for more air flow. Cooling systems with electric cooling fans do not respond to engine rpm. The added cooling from higher coolant flow is more than offset by increased heat from higher engine output.
- If vehicle is equipped with a V-6 or V-8 engine, increasing engine speed for more air flow is recommended.

(1) TRAILER TOWING:

Consult Trailer Towing section of owners manual. Do not exceed limits.

(2) AIR CONDITIONING; ADD-ON OR AFTER MARKET:

A maximum cooling package should have been ordered with vehicle if add-on or after market A/C is installed. If not, maximum cooling system components should be installed for model involved per manufacturer's specifications.

(3) RECENT SERVICE OR ACCIDENT REPAIR:

Determine if any recent service has been performed on vehicle that may effect cooling system. This may be:

- Engine adjustments (incorrect timing)
- Slipping engine accessory drive belt(s)
- Brakes (possibly dragging)
- Changed parts. Incorrect water pump, or pump rotating in wrong direction due to belt not correctly routed
- Reconditioned radiator or cooling system refilling (possibly under filled or air trapped in system).

NOTE: If investigation reveals none of the previous items as a cause for an engine overheating complaint, refer to following Cooling System Diagnosis charts.

These charts are to be used as a quick-reference only. Refer to the group text for information.

DIAGNOSIS AND TESTING (Continued)

COOLING SYSTEM

COOLING SYSTEM DIAGNOSIS CHART

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|--|---|
| TEMPERATURE GAUGE READS LOW | <ol style="list-style-type: none"> 1. Has a Diagnostic Trouble Code (DTC) been set indicating a stuck open thermostat? 2. Is the temperature sending unit connected? 3. Is the temperature gauge operating OK? 4. Coolant level low in cold ambient temperatures accompanied with poor heater performance. 5. Improper operation of internal heater doors or heater controls. | <ol style="list-style-type: none"> 1. Refer to Group 25, Emission Systems for On-Board Diagnostics and DTC information. Replace thermostat if necessary. 2. Check the temperature sensor connector. Refer to Group 8E. Repair connector if necessary. 3. Check gauge operation. Refer to Group 8E. Repair as necessary. 4. Check coolant level in the coolant reserve/overflow tank and the radiator. Inspect system for leaks. Repair leaks as necessary. Refer to the Coolant section of the manual text for WARNINGS and CAUTIONS associated with removing the radiator cap. 5. Inspect heater and repair as necessary. Refer to Group 24, Heating and Air Conditioning for procedures. |
| TEMPERATURE GAUGE READS HIGH OR THE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST OR LEAKING FROM THE COOLING SYSTEM | <ol style="list-style-type: none"> 1. Trailer is being towed, a steep hill is being climbed, vehicle is operated in slow moving traffic, or engine is being idled with very high ambient (outside) temperatures and the air conditioning is on. Higher altitudes could aggravate these conditions. 2. Is the temperature gauge reading correctly? 3. Is the temperature warning illuminating unnecessarily? 4. Coolant low in coolant reserve/overflow tank and radiator? 5. Pressure cap not installed tightly. If cap is loose, boiling point of coolant will be lowered. Also refer to the following Step 6. | <ol style="list-style-type: none"> 1. This may be a temporary condition and repair is not necessary. Turn off the air conditioning and attempt to drive the vehicle without any of the previous conditions. Observe the temperature gauge. The gauge should return to the normal range. If the gauge does not return to the normal range, determine the cause for overheating and repair. Refer to Possible Causes (2-20). 2. Check gauge. Refer to Group 8E. Repair as necessary. 3. Check warning lamp operation. Refer to Group 8E. Repair as necessary. 4. Check for coolant leaks and repair as necessary. Refer to Testing Cooling System for Leaks in this Group. 5. Tighten cap |

DIAGNOSIS AND TESTING (Continued)

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|--|--|--|
| TEMPERATURE GAUGE READS HIGH OR THE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST OR LEAKING FROM THE COOLING SYSTEM (cont) | <p>6. Poor seals at the radiator cap.</p> <p>(b) Check condition of radiator filler neck. If neck is bent or damaged, replace radiator.</p> <p>7. Coolant level low in radiator but not in coolant reserve/overflow tank. This means the radiator is not drawing coolant from the coolant reserve/overflow tank as the engine cools</p> <p>8. Incorrect coolant concentration</p> <p>9. Coolant not flowing through system</p> <p>10. Radiator or A/C condenser fins are dirty or clogged.</p> <p>11. Radiator core is corroded or plugged.</p> <p>12. Aftermarket A/C installed without proper radiator.</p> <p>13. Fuel or ignition system problems.</p> <p>14. Dragging brakes.</p> <p>15. Bug screen or cardboard is being used, reducing airflow.</p> <p>16. Thermostat partially or completely shut.</p> | <p>6. (a) Check condition of cap and cap seals. Refer to Radiator Cap. Replace cap if necessary.</p> <p>7. (a) Check condition of radiator cap and cap seals. Refer to Radiator Cap in this Group. Replace cap if necessary.</p> <p>(b) Check condition of radiator filler neck. If neck is bent or damaged, replace radiator.</p> <p>(c) Check condition of the hose from the radiator to the coolant tank. It should fit tight at both ends without any kinks or tears. Replace hose if necessary.</p> <p>(d) Check coolant reserve/overflow tank and tanks hoses for blockage. Repair as necessary.</p> <p>8. Check coolant. Refer to Coolant section in this Group for correct coolant/water mixture ratio.</p> <p>9. Check for coolant flow at radiator filler neck with some coolant removed, engine warm and thermostat open. Coolant should be observed flowing through radiator. If flow is not observed, determine area of obstruction and repair as necessary.</p> <p>10. Remove insects and debris. Refer to Radiator Cleaning in this Group.</p> <p>11. Have radiator re-cored or replaced.</p> <p>12. Install proper radiator.</p> <p>13. Refer to Fuel and Ignition System Groups for diagnosis.</p> <p>14. Check and correct as necessary. Refer to Group 5, Brakes for correct procedures.</p> <p>15. Remove bug screen or cardboard.</p> <p>16. Check thermostat operation and replace as necessary. Refer to Thermostats in this Group.</p> |

DIAGNOSIS AND TESTING (Continued)

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|--|--|---|
| TEMPERATURE GAUGE READS HIGH OR THE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST OR LEAKING FROM THE COOLING SYSTEM (cont) | <p>17. Viscous fan drive not operating properly.</p> <p>18. Electric cooling fan not operating properly (vehicles equipped with 2.5L engine)</p> <p>19. Cylinder head gasket leaking.</p> <p>20. Heater core leaking.</p> | <p>17. Check fan drive operation and replace as necessary. Refer to Viscous Fan Drive in this Group.</p> <p>18. Check electric fan operation and repair as necessary. Refer to Electric Cooling Fan in this Group.</p> <p>19. Check for cylinder head gasket leaks. Refer to Cooling System-Testing For Leaks in this Group. For repair, refer to Group 9, Engines.</p> <p>20. Check heater core for leaks. Refer to Group 24, Heating and Air Conditioning. Repair as necessary.</p> |
| TEMPERATURE GAUGE READING IS INCONSISTENT (FLUCTUATES, CYCLES OR IS ERRATIC) | <p>1. On vehicles equipped with an electric fan, the gauge may cycle up and down. This is due to the cycling of the electric radiator fan.</p> <p>2. During cold weather operation, with the heater blower in the high position, the gauge reading may drop slightly.</p> <p>3. Temperature gauge or engine mounted gauge sensor defective or shorted. Also, corroded or loose wiring in this circuit.</p> <p>4. Gauge reading rises when vehicle is brought to a stop after heavy use (engine still running)</p> <p>5. Gauge reading high after re-starting a warmed up (hot) engine.</p> <p>6. Coolant level low in radiator (air will build up in the cooling system causing the thermostat to open late).</p> <p>7. Cylinder head gasket leaking allowing exhaust gas to enter cooling system causing a thermostat to open late.</p> <p>8. Water pump impeller loose on shaft.</p> | <p>1. This is a normal condition. No correction is necessary unless the gauge cycles into the red (overheat) zone. Refer to Electric Cooling Fan Diagnosis and Testing in this group.</p> <p>2. A normal condition. No correction is necessary.</p> <p>3. Check operation of gauge and repair if necessary. Refer to Group 8E, Instrument Panel and Gauges.</p> <p>4. A normal condition. No correction is necessary. Gauge should return to normal range after vehicle is driven.</p> <p>5. A normal condition. No correction is necessary. The gauge should return to normal range after a few minutes of engine operation.</p> <p>6. Check and correct coolant leaks. Refer to Cooling System-Testing for leaks in this group.</p> <p>7. (a) Check for cylinder head gasket leaks. Refer to Cooling System-Testing for Leaks in this group. (b) Check for coolant in the engine oil. Inspect for white steam emitting from the exhaust system. Repair as necessary.</p> <p>8. Check water pump and replace as necessary. Refer to water Pumps in this group.</p> |

DIAGNOSIS AND TESTING (Continued)

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|--|---|---|
| TEMPERATURE GAUGE READING IS INCONSISTENT (FLUCTUATES, CYCLES OR IS ERRATIC) | <p>9. Loose accessory drive belt. (water pump slipping)</p> <p>10. Air leak on the suction side of the water pump allows air to build up in cooling system causing thermostat to open late.</p> | <p>9. Refer to Accessory Drive Belts in this group. Check and correct as necessary.</p> <p>10. Locate leak and repair as necessary.</p> |
| PRESSURE CAP IS BLOWING OFF STEAM AND/OR COOLANT TO COOLANT TANK. TEMPERATURE GAUGE READING MAY BE ABOVE NORMAL BUT NOT HIGH. COOLANT LEVEL MAY BE HIGH IN COOLANT RESERVE/OVERFLOW TANK | 1. Pressure relief valve in radiator cap is defective. | 1. Check condition of radiator cap and cap seals. Refer to Radiator Caps in this group. Replace cap as necessary. |
| COOLANT LOSS TO THE GROUND WITHOUT PRESSURE CAP BLOWOFF. GAUGE READING HIGH OR HOT | 1. Coolant leaks in radiator, cooling system hoses, water pump or engine. | 1. Pressure test and repair as necessary. Refer to Cooling System-Testing For Leaks in this group. |
| DETONATION OR PRE-IGNITION (NOT CAUSED BY IGNITION SYSTEM). GAUGE MAY OR MAY NOT BE READING HIGH | <p>1. engine overheating.</p> <p>2. Freeze point of coolant not correct. Mixture is too rich or too lean.</p> | <p>1. Check reason for overheating and repair as necessary.</p> <p>2. Check coolant concentration. Refer to the Coolant section of this group and adjust ratio as required.</p> |
| HOSE OR HOSES COLLAPSE WHILE ENGINE IS RUNNING | 1. Vacuum created in cooling system on engine cool-down is not being relieved through coolant reserve/overflow system. | <p>1. (a) Radiator cap relief valve stuck. Refer to Radiator Cap in this group. Replace if necessary</p> <p>(b) Hose between coolant reserve/overflow tank and radiator is kinked. Repair as necessary.</p> <p>(c) Vent at coolant reserve/overflow tank is plugged. Clean vent and repair as necessary.</p> <p>(d) Reserve/overflow tank is internally blocked or plugged. Check for blockage and repair as necessary.</p> |
| ELECTRIC RADIATOR FAN RUNS ALL OF THE TIME | 1. Fan relay, powertrain control module (PCM) or coolant temperature sensor defective. | 1. Refer to Electric Cooling Fan Diagnosis and Testing. Also refer to Group 8W, Wiring Diagrams. Repair as necessary. |

DIAGNOSIS AND TESTING (Continued)

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|--|--|--|
| ELECTRIC RADIATOR FAN WILL NOT RUN AT ALL. GAUGE READING HIGH OR HOT | <ol style="list-style-type: none"> 1. Blown Fuse in Power Distribution Center (PDC) 2. Fan relay, powertrain control module (PCM) or coolant temperature sensor defective. 3. Fan Motor Defective | <ol style="list-style-type: none"> 1. Determine reason for blown fuse and repair as necessary. 2. Refer to Electric Cooling Fan Diagnosis and Testing. Also refer to Group 8W, Wiring Diagrams. Repair as necessary. 3. Refer to Electric Cooling Fan Diagnosis and Testing. Also refer to Group 8W, Wiring Diagrams. Repair as necessary. |
| NOISY VISCOUS FAN/DRIVE | <ol style="list-style-type: none"> 1. Fan blades loose. 2. Fan blades striking a surrounding object. 3. Air obstructions at radiator or air conditioning condenser. 4. Thermal viscous fan drive has defective bearing. 5. A certain amount of fan noise may be evident on models equipped with a thermal viscous fan drive. Some of this noise is normal. | <ol style="list-style-type: none"> 1. Replace fan blade assembly. Refer to Cooling System Fans in this Group 2. Locate point of fan blade contact and repair as necessary. 3. Remove obstructions and/or clean debris or insects from radiator or A/C condenser. 4. Replace fan drive. Bearing is not serviceable. Refer to Viscous Fan Drive in this group. 5. Refer to Viscous Fan Drive in this group for an explanation of normal fan noise. |
| INADEQUATE HEATER PERFORMANCE. THERMOSTAT FAILED IN OPEN POSITION | <ol style="list-style-type: none"> 1. Has a Diagnostic trouble Code (DTC) been set? 2. Coolant level low 3. Obstructions in heater hose/fittings 4. Heater hose kinked 5. Water pump is not pumping water to/through the heater core. When the engine is fully warmed up, both heater hoses should be hot to the touch. If only one of the hoses is hot, the water pump may not be operating correctly or the heater core may be plugged. Accessory drive belt may be slipping causing poor water pump operation. | <ol style="list-style-type: none"> 1. Refer to Group 25, Emissions for correct procedures and replace thermostat if necessary 2. Refer to Cooling System-Testing For Leaks in this group. 3. Remove heater hoses at both ends and check for obstructions 4. Locate kinked area and repair as necessary 5. Refer to Water Pump in this group. If a slipping belt is detected, refer to Accessory Drive Belts in this group. If heater core obstruction is detected, refer to Group 24, Heating and Air Conditioning. |

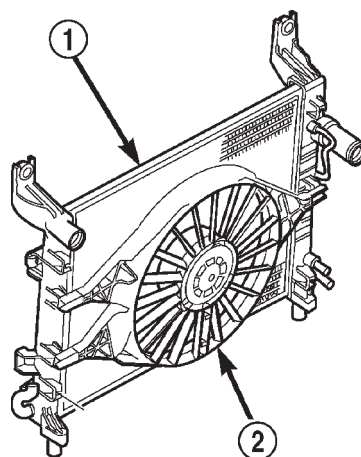
DIAGNOSIS AND TESTING (Continued)

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|---|---|---|
| STEAM IS COMING FROM THE FRONT OF VEHICLE NEAR THE GRILL AREA WHEN WEATHER IS WET, ENGINE IS WARMED UP AND RUNNING, AND VEHICLE IS STATIONARY. TEMPERATURE GAUGE IS IN NORMAL RANGE | 1. During wet weather, moisture (snow, ice or rain condensation) on the radiator will evaporate when the thermostat opens. This opening allows heated water into the radiator. When the moisture contacts the hot radiator, steam may be emitted. This usually occurs in cold weather with no fan or airflow to blow it away. | 1. Occasional steam emitting from this area is normal. No repair is necessary. |
| COOLANT COLOR | 1. Coolant color is not necessarily an indication of adequate corrosion or temperature protection. Do not rely on coolant color for determining condition of coolant. | 1. Refer to Coolant in this group for coolant concentration information. Adjust coolant mixture as necessary. |
| COOLANT LEVEL CHANGES IN COOLANT RESERVE/OVERFLOW TANK. TEMPERATURE GAUGE IS IN NORMAL RANGE | 1. Level changes are to be expected as coolant volume fluctuates with engine temperature. If the level in the tank was between the FULL and ADD marks at normal operating temperature, the level should return to within that range after operation at elevated temperatures. | 1. A normal condition. No repair is necessary. |

ELECTRIC COOLING FAN

The powertrain control module (PCM) will set a diagnostic trouble code (DTC) in memory if it detects a problem in the electric cooling fan relay or circuit. Refer to On-Board Diagnostics in Group 25, Emission Control Systems for more information on accessing a DTC.

The DTC can also be accessed through the DRB scan tool. Refer to the appropriate Powertrain Diagnostic Procedures manual for diagnostic information and operation of the DRB scan tool.



80bcbd2d

Fig. 24 Electrical Fan Assembly—Typical

- 1 – RADIATOR
2 – ELECTRIC FAN ASSEMBLY

DIAGNOSIS AND TESTING (Continued)

RADIATOR FAN MOTOR INOPERATIVE

Equipment Required:

- DRB Scan Tool
- Volt/Ohm meter
- Wiring Diagrams section of this manual

Test Procedure:

(1) Inspect 10A fuse in junction block and 40A maxi fuse in PDC (Fig. 25).

(2) Remove Cooling Fan Relay from the PDC and make the following checks at the relay connector:

- Apply 12 volts (using a fused 14-gauge wire) to circuit C25 (relay terminal 87). If fan does not come on, check for open in circuit C25 or Z1. If circuits are o.k., replace the cooling fan motor.

- With the ignition key "off" check for battery voltage at circuit C28 (relay terminal 30). If no battery voltage present check for open/shorted circuit C28 between the PDC and relay.

- With the ignition key in the "run" position check for battery voltage at circuit F18 (relay terminal 86). If no battery voltage present, check for open/short in circuit F18 between the junction block and the relay.

- If no problems are detected, install the DRB (refer to the appropriate Powertrain Diagnostic Procedures manual for DRB scan tool operating instructions) and start the engine. Clip a 12V test light to the battery positive terminal and probe circuit C27 (relay terminal 85). When the engine temperature reaches 110° C (230° F), or A/C is selected, the test light should light. If not, check circuit C27 for open.

- If no problems are detected at this point, replace the cooling fan relay.

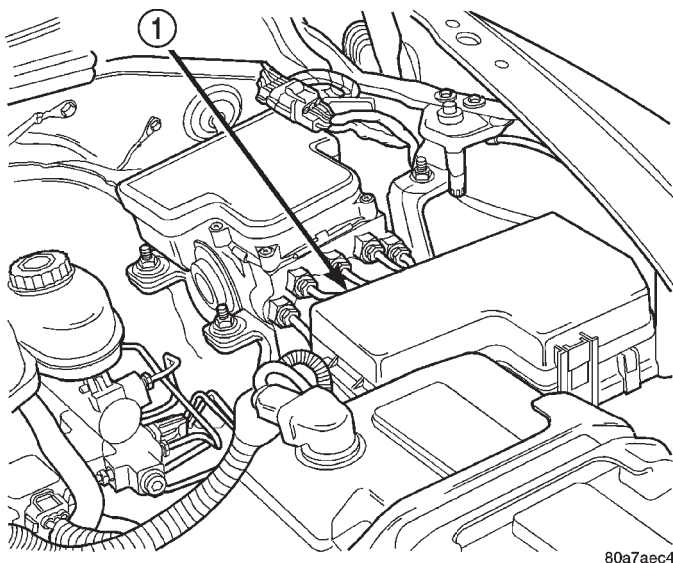


Fig. 25 Power Distribution Center (PDC)

1 - POWER DISTRIBUTION CENTER (PDC)

RADIATOR COOLANT FLOW CHECK

Use the following procedure to determine if coolant is flowing through cooling system.

(1) Idle engine until operating temperature is reached. If upper radiator hose is warm to the touch, thermostat is opening and coolant is flowing to radiator.

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. USING A RAG TO COVER RADIATOR PRESSURE CAP, OPEN RADIATOR CAP SLOWLY TO FIRST STOP. ALLOW ANY BUILT-UP PRESSURE TO VENT TO THE RESERVE/OVERFLOW TANK. AFTER PRESSURE BUILD-UP HAS BEEN RELEASED, REMOVE CAP FROM FILLER NECK.

(2) Drain a small amount of coolant from radiator until ends of radiator tubes are visible through filler neck. Idle engine at normal operating temperature. If coolant is flowing past exposed tubes, coolant is circulating.

COOLING SYSTEM—TESTING FOR LEAKS

ULTRAVIOLET LIGHT METHOD

A leak detection additive is available through the parts department that can be added to cooling system. The additive is highly visible under ultraviolet light (black light). Pour one ounce of additive into cooling system. Place heater control unit in HEAT position. Start and operate engine until radiator upper hose is warm to touch. Aim the commercially available black light tool at components to be checked. If leaks are present, black light will cause additive to glow a bright green color.

The black light can be used in conjunction with a pressure tester to determine if any external leaks exist (Fig. 26).

PRESSURE TESTER METHOD

The engine should be at normal operating temperature. Recheck the system cold if cause of coolant loss is not located during the warm engine examination.

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING.

Carefully remove radiator pressure cap from filler neck and check coolant level. Push down on cap to disengage it from stop tabs. Wipe inside of filler neck and examine lower inside sealing seat for nicks, cracks, paint, dirt and solder residue. Inspect radiator-to- reserve/overflow tank hose for internal obstructions. Insert a wire through the hose to be sure it is not obstructed.

DIAGNOSIS AND TESTING (Continued)

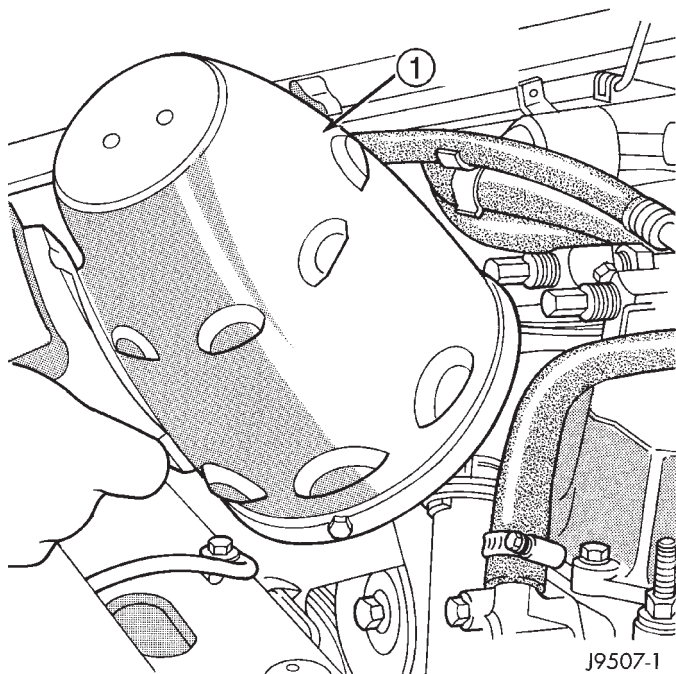


Fig. 26 Leak Detection Using Black Light—Typical

1 - TYPICAL BLACK LIGHT TOOL

Inspect cams on outside of filler neck. If cams are damaged, seating of pressure cap valve and tester seal will be affected.

Attach pressure tester (7700 or an equivalent) to radiator filler neck (Fig. 27).

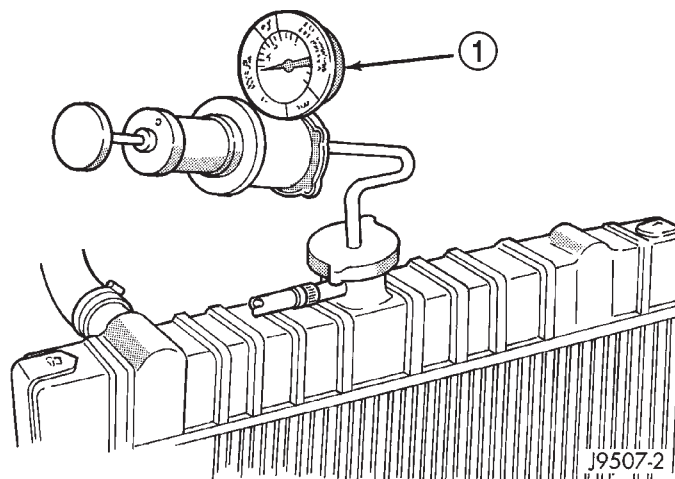


Fig. 27 Pressure Testing Cooling System—Typical

1 - TYPICAL COOLING SYSTEM PRESSURE TESTER

Operate tester pump to apply 103.4 kPa (15 psi) pressure to system. If hoses enlarge excessively or bulges while testing, replace as necessary. Observe gauge pointer and determine condition of cooling system according to following criteria:

Holds Steady: If pointer remains steady for two minutes, serious coolant leaks are not present in system. However, there could be an internal leak that does not appear with normal system test pressure. If it is certain that coolant is being lost and leaks cannot be detected, inspect for interior leakage or perform Internal Leakage Test.

Drops Slowly: Indicates a small leak or seepage is occurring. Examine all connections for seepage or slight leakage with a flashlight. Inspect radiator, hoses, gasket edges and heater. Seal small leak holes with a Sealer Lubricant (or equivalent). Repair leak holes and inspect system again with pressure applied.

Drops Quickly: Indicates that serious leakage is occurring. Examine system for external leakage. If leaks are not visible, inspect for internal leakage. Large radiator leak holes should be repaired by a reputable radiator repair shop.

INTERNAL LEAKAGE INSPECTION

Remove engine oil pan drain plug and drain a small amount of engine oil. If coolant is present in the pan, it will drain first because it is heavier than oil. An alternative method is to operate engine for a short period to churn the oil. After this is done, remove engine dipstick and inspect for water globules. Also inspect transmission dipstick for water globules and transmission fluid cooler for leakage.

WARNING: WITH RADIATOR PRESSURE TESTER TOOL INSTALLED ON RADIATOR, DO NOT ALLOW PRESSURE TO EXCEED 110 KPA (20 PSI). PRESSURE WILL BUILD UP QUICKLY IF A COMBUSTION LEAK IS PRESENT. TO RELEASE PRESSURE, ROCK TESTER FROM SIDE TO SIDE. WHEN REMOVING TESTER, DO NOT TURN TESTER MORE THAN 1/2 TURN IF SYSTEM IS UNDER PRESSURE.

Operate engine without pressure cap on radiator until thermostat opens. Attach a Pressure Tester to filler neck. If pressure builds up quickly it indicates a combustion leak exists. This is usually the result of a cylinder head gasket leak or crack in engine. Repair as necessary.

DIAGNOSIS AND TESTING (Continued)

If there is not an immediate pressure increase, pump the Pressure Tester. Do this until indicated pressure is within system range of 110 kPa (16 psi). Fluctuation of gauge pointer indicates compression or combustion leakage into cooling system.

Because the vehicle is equipped with a catalytic converter, **do not** remove spark plug cables or short out cylinders to isolate compression leak.

If the needle on dial of pressure tester does not fluctuate, race engine a few times to check for an abnormal amount of coolant or steam. This would be emitting from exhaust pipe. Coolant or steam from exhaust pipe may indicate a faulty cylinder head gasket, cracked engine cylinder block or cylinder head.

A convenient check for exhaust gas leakage into cooling system is provided by a commercially available Block Leak Check tool. Follow manufacturers instructions when using this product.

COMBUSTION LEAKAGE TEST—WITHOUT PRESSURE TESTER

DO NOT WASTE reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

WARNING: DO NOT REMOVE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN RADIATOR DRAIN- COCK WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

Drain sufficient coolant to allow thermostat removal. Refer to Thermostat Replacement. Disconnect water pump drive belt.

Add coolant to radiator to bring level to within 6.3 mm (1/4 in) of top of thermostat housing.

CAUTION: Avoid overheating. Do not operate engine for an excessive period of time. Open drain-cock immediately after test to eliminate boil over.

Start engine and accelerate rapidly three times, to approximately 3000 rpm while observing coolant. If internal engine combustion gases are leaking into cooling system, bubbles will appear in coolant. If bubbles do not appear, internal combustion gas leakage is not present.

VISCIOUS FAN DRIVE—3.9L/4.7L and 5.9L ENGINES

If the fan assembly free-wheels without drag (the fan blades will revolve more than five turns when

spun by hand), replace the fan drive. This spin test must be performed when the engine is cool.

For the following test, the cooling system must be in good condition. It also will ensure against excessively high coolant temperature.

WARNING: BE SURE THAT THERE IS ADEQUATE FAN BLADE CLEARANCE BEFORE DRILLING.

(1) Drill a 3.18-mm (1/8-in) diameter hole in the top center of the fan shroud between the washer and coolant reservoirs along the pinch flange. Be careful not to pierce the reservoirs..

(2) Obtain a dial thermometer with an 8 inch stem (or equivalent). It should have a range of -18° to 105°C (0° to 220° F). Insert thermometer through the hole in the shroud. Be sure that there is adequate clearance from the fan blades.

(3) Connect a tachometer and an engine ignition timing light (timing light is to be used as a strobe light).

(4) Block the air flow through the radiator. Secure a sheet of plastic in front of the radiator (or air conditioner condenser). Use tape at the top to secure the plastic and be sure that the air flow is blocked.

(5) Be sure that the air conditioner (if equipped) is turned off.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(6) Start the engine and operate at 2400 rpm. Within ten minutes the air temperature (indicated on the dial thermometer) should be up to 96° C (205° F). Fan drive **engagement** should have started to occur at between 88° to 96° C (190° to 205° F). Engagement is distinguishable by a definite **increase** in fan flow noise (roaring). The timing light also will indicate an increase in the speed of the fan.

(7) When the air temperature reaches 96° C (205° F), remove the plastic sheet. Fan drive **disengagement** should have started to occur at between 57° to 79° C (135° to 175° F). A definite **decrease** of fan flow noise (roaring) should be noticed. If not, replace the defective viscous fan drive unit.

DIAGNOSIS AND TESTING (Continued)

ACCESSORY DRIVE BELT DIAGNOSIS

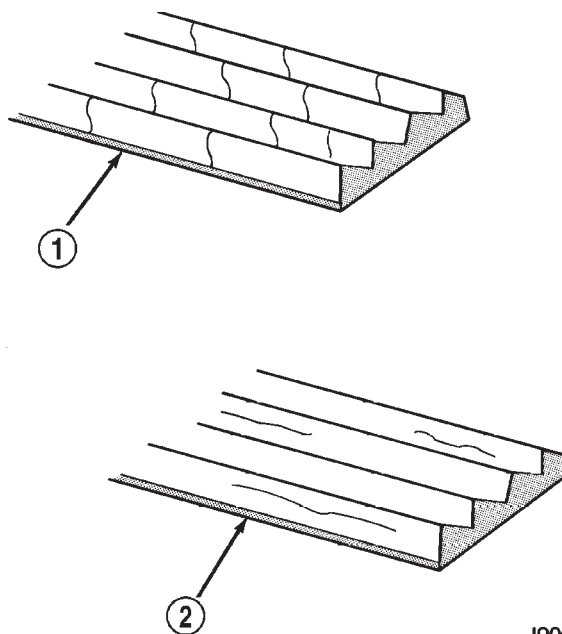
VISUAL DIAGNOSIS

When diagnosing serpentine accessory drive belts, small cracks that run across the ribbed surface of the belt from rib to rib (Fig. 28), are considered normal. These are not a reason to replace the belt. However, cracks running along a rib (not across) are **not** normal. Any belt with cracks running along a rib must be replaced (Fig. 28). Also replace the belt if it has excessive wear, frayed cords or severe glazing.

Refer to the Accessory Drive Belt Diagnosis charts for further belt diagnosis.

NOISE DIAGNOSIS

Noises generated by the accessory drive belt are most noticeable at idle. Before replacing a belt to resolve a noise condition, inspect all of the accessory drive pulleys for alignment, glazing, or excessive end play.



J9007-44

Fig. 28 Belt Wear Patterns

- 1 – NORMAL CRACKS BELT OK
2 – NOT NORMAL CRACKS REPLACE BELT

ACCESSORY DRIVE BELT DIAGNOSIS CHART

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|--|--|--|
| RIB CHUNKING (One or more ribs has separated from belt body) | <ol style="list-style-type: none"> 1. Foreign objects imbedded in pulley grooves. 2. Installation damage | <ol style="list-style-type: none"> 1. Remove foreign objects from pulley grooves. Replace belt. 2. Replace belt |
| RIB OR BELT WEAR | <ol style="list-style-type: none"> 1. Pulley misaligned 2. Abrasive environment 3. Rusted pulley(s) 4. Sharp or jagged pulley groove tips 5. Belt rubber deteriorated | <ol style="list-style-type: none"> 1. Align pulley(s) 2. Clean pulley(s). Replace belt if necessary 3. Clean rust from pulley(s) 4. Replace pulley. Inspect belt. 5. Replace belt |

DIAGNOSIS AND TESTING (Continued)

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|--|--|---|
| BELT SLIPS | <ol style="list-style-type: none"> 1. Belt slipping because of insufficient tension 2. Belt or pulley exposed to substance that has reduced friction (belt dressing, oil, ethylene glycol) 3. Driven component bearing failure (seizure) 4. Belt glazed or hardened from heat and excessive slippage | <ol style="list-style-type: none"> 1. Adjust tension (2.5L). Replace tensioner (3.9L/4.7L/5.9L Engines) 2. Replace belt and clean pulleys 3. Replace faulty component or bearing 4. Replace belt. |
| LONGITUDAL BELT CRACKING | <ol style="list-style-type: none"> 1. Belt has mistracked from pulley groove 2. Pulley groove tip has worn away rubber to tensile member | <ol style="list-style-type: none"> 1. Replace belt 2. Replace belt |
| "GROOVE JUMPING" (Belt does not maintain correct position on pulley) | <ol style="list-style-type: none"> 1. Belt tension either too low or too high 2. Pulley(s) not within design tolerance 3. Foreign object(s) in grooves 4. Pulley misalignment 5. Belt cordline is broken | <ol style="list-style-type: none"> 1. Adjust belt tension (2.5L). Replace tensioner (3.9L/4.7L/5.9L Engines) 2. Replace pulley(s) 3. Remove foreign objects from grooves 4. Align component 5. Replace belt |
| BELT BROKEN (Note: Identify and correct problem before new belt is installed) | <ol style="list-style-type: none"> 1. Excessive tension (2.5L) 2. Tensile member damaged during belt installation 3. Severe misalignment 4. Bracket, pulley, or bearing failure | <ol style="list-style-type: none"> 1. Replace belt and adjust tension to specification 2. Replace belt 3. Align pulley(s) 4. Replace defective component and belt |
| NOISE (Objectionable squeal, squeak, or rumble is heard or felt while drive belt is in operation) | <ol style="list-style-type: none"> 1. Belt slippage 2. Bearing noise 3. Belt misalignment 4. Belt to pulley mismatch 5. Driven component induced vibration 6. System resonant frequency induced vibration | <ol style="list-style-type: none"> 1. Adjust belt (2.5L). Replace tensioner (3.9L/4.7L/5.9L Engines) 2. Locate and repair 3. Align belt/pulley(s) 4. Install correct belt 5. Locate defective driven component and repair 6. Vary belt tension within specifications. |

DIAGNOSIS AND TESTING (Continued)

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|--|--|---|
| TENSION SHEETING FABRIC FAILURE (Woven fabric on outside, circumference of belt has cracked or separated from body of belt) | <ol style="list-style-type: none"> 1. Tension sheeting contacting stationary object 2. Excessive heat causing woven fabric to age 3. Tension sheeting splice has fractured | <ol style="list-style-type: none"> 1. Correct rubbing condition 2. Replace belt 3. Replace belt |
| CORD EDGE FAILURE (Tensile member exposed at edges of belt or separated from belt body) | <ol style="list-style-type: none"> 1. Excessive tension 2. Belt contacting stationary object 3. Pulley(s) out of tolerance 4. Insufficient adhesion between tensile member and rubber matrix | <ol style="list-style-type: none"> 1. Adjust belt tension (2.5L). Replace tensioner (3.9L/4.7L/5.9L Engines) 2. Replace belt 3. Replace pulley 4. Replace belt and adjust tension to specifications |

THERMOSTAT

All models are equipped with On-Board Diagnostics for certain cooling system components. Refer to On-Board Diagnostics (OBD) in the Diagnosis section of this group for additional information. If the powertrain control module (PCM) detects low engine coolant temperature, it may record a Diagnostic Trouble Code (DTC) in the PCM memory. Do not change a thermostat for lack of heat as indicated by the instrument panel gauge or heater performance unless a DTC is present. Refer to the Diagnosis section of this group for other probable causes. For other DTC numbers, refer to On-Board Diagnostics in the Group 25, Emission Control Systems.

The DTC can also be accessed through the DRB scan tool. Refer to the appropriate Powertrain Diagnostic Procedures manual for diagnostic information and operation of the DRB scan tool.

RADIATOR CAP-TO-FILLER NECK SEAL—PRESSURE RELIEF CHECK

The pressure cap upper gasket (seal) pressure relief can be tested by removing overflow hose from radiator filler neck nipple. Attach hose of pressure tester tool 7700 (or equivalent) to nipple. It will be necessary to disconnect hose from its adapter for filler neck. Pump air into radiator. The pressure cap upper gasket should relieve at 69-124 kPa (10-18 psi) and hold pressure at a minimum of 55 kPa (8 psi).

WARNING: THE WARNING WORDS —DO NOT OPEN HOT— ON RADIATOR PRESSURE CAP, ARE A SAFETY PRECAUTION. WHEN HOT, PRESSURE BUILDS UP IN COOLING SYSTEM. TO PREVENT SCALDING OR INJURY, RADIATOR CAP SHOULD NOT BE REMOVED WHILE SYSTEM IS HOT AND/OR UNDER PRESSURE.

Do not remove radiator cap at any time **except** for the following purposes:

- (1) Check and adjust antifreeze freeze point.
- (2) Refill system with new antifreeze.
- (3) Conducting service procedures.
- (4) Checking for vacuum leaks.

WARNING: IF VEHICLE HAS BEEN RUN RECENTLY, WAIT AT LEAST 15 MINUTES BEFORE REMOVING RADIATOR CAP. WITH A RAG, SQUEEZE RADIATOR UPPER HOSE TO CHECK IF SYSTEM IS UNDER PRESSURE. PLACE A RAG OVER CAP AND WITHOUT PUSHING CAP DOWN, ROTATE IT COUNTER-CLOCKWISE TO FIRST STOP. ALLOW FLUID TO ESCAPE THROUGH THE COOLANT RESERVE/OVERFLOW HOSE INTO RESERVE/OVERFLOW TANK. SQUEEZE RADIATOR UPPER HOSE TO DETERMINE WHEN PRESSURE HAS BEEN RELEASED. WHEN COOLANT AND STEAM STOP BEING PUSHED INTO TANK AND SYSTEM PRESSURE DROPS, REMOVE RADIATOR CAP COMPLETELY.

RADIATOR CAP—PRESSURE TESTING

Remove cap from radiator. Be sure that sealing surfaces are clean. Moisten rubber gasket with water and install cap on pressure tester 7700 or an equivalent (Fig. 29).

Operate tester pump to bring pressure to 117 kPa (17 psi) on gauge. If pressure cap fails to hold pressure of at least 110 kPa (16 psi) replace cap. Refer to following **CAUTION**.

The pressure cap may test properly while positioned on tool 7700 (or equivalent). It may not hold pressure or vacuum when installed on radiator. If so, inspect radiator filler neck and cap's top gasket for

DIAGNOSIS AND TESTING (Continued)

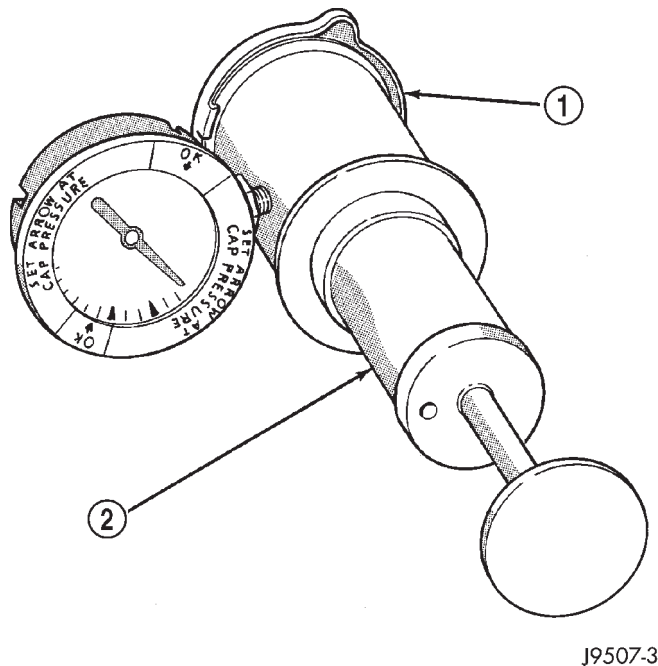


Fig. 29 Pressure Testing Radiator Cap—Typical

- 1 - PRESSURE CAP
2 - TYPICAL COOLING SYSTEM PRESSURE TESTER

damage. Also inspect for dirt or distortion that may prevent cap from sealing properly.

CAUTION: Radiator pressure testing tools are very sensitive to small air leaks, which will not cause cooling system problems. A pressure cap that does not have a history of coolant loss should not be replaced just because it leaks slowly when tested with this tool. Add water to tool. Turn tool upside down and recheck pressure cap to confirm that cap needs replacement.

COOLANT—LOW LEVEL AERATION

If the coolant level in radiator drops below top of radiator core tubes, air will enter cooling system. On 2.5L engines, air can gather in the water box containing the thermostat.

Low coolant level can cause thermostat pellet to be suspended in air instead of coolant. This will cause thermostat to open later, which in turn causes higher coolant temperature. Air trapped in cooling system also reduces amount of coolant circulating in heater core resulting in low heat output.

COOLING SYSTEM—DEAERATION

As the engine operates, any air trapped in cooling system gathers under the radiator cap. The next time the engine is operated, thermal expansion of coolant will push any trapped air past radiator cap into the coolant reserve/overflow tank. Here it escapes to the

atmosphere into the tank. When the engine cools down the coolant, it will be drawn from the reserve/overflow tank into the radiator to replace any removed air.

SERVICE PROCEDURES

COOLANT—ROUTINE LEVEL CHECK

NOTE: Do not remove radiator cap for routine coolant level inspections. The coolant level can be checked at coolant recovery bottle (Fig. 30).

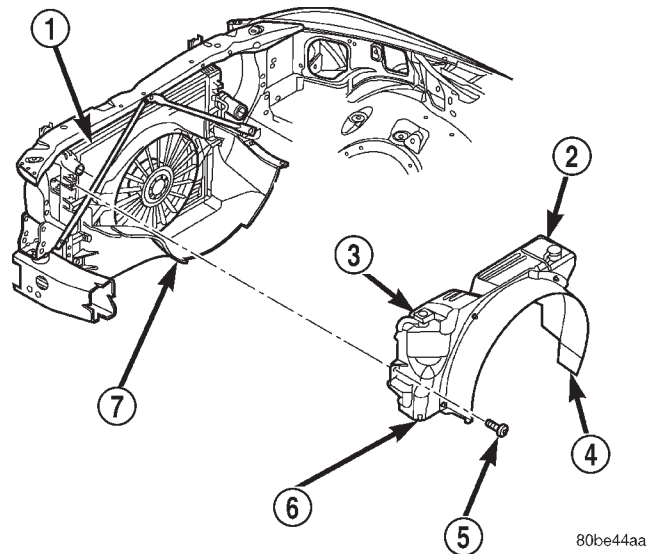


Fig. 30 Coolant Recovery Bottle Location

- 1 - RADIATOR
2 - WASHER FLUID RESERVOIR
3 - COOLANT OVERFLOW/RESERVOIR
4 - FAN SHROUD (UPPER)
5 - SCREW
6 - INTERLOCKING PINS
7 - FAN SHROUD (LOWER)

The coolant reserve/overflow system provides a quick method for determining coolant level without removing radiator pressure cap. With engine not running, open the coolant recovery bottle cap and remove coolant level indicator dipstick to observe coolant level in coolant recovery bottle. The coolant level should be between ADD and FULL marks. If the coolant level is at or below the ADD mark, fill the recovery bottle with a 50/50 mixture of antifreeze and water ONE QUART AT A TIME. Repeat this procedure until the coolant level is at the FULL mark.

COOLANT SERVICE

For cooling system flush and fill maintenance intervals, refer to Group 0, Lubrication and Maintenance.

SERVICE PROCEDURES (Continued)

COOLANT—ADDING ADDITIONAL

Do not remove radiator cap to add coolant to system. When adding coolant to maintain correct level, do so at coolant reserve/overflow tank. Use a 50/50 mixture of ethylene glycol antifreeze containing Alugard 340-2 [™] and low mineral content water. Remove radiator cap only for testing or when refilling system after service. Removing cap unnecessarily can cause loss of coolant and allow air to enter system, which produces corrosion.

COOLANT LEVEL CHECK

The cooling system is closed and designed to maintain coolant level to top of radiator.

WARNING: DO NOT OPEN RADIATOR DRAINCOCK WITH ENGINE RUNNING OR WHILE ENGINE IS HOT AND COOLING SYSTEM IS UNDER PRESSURE.

Remove radiator cap. The coolant level should be to top of radiator. If not, and if coolant level in coolant recovery bottle is at ADD mark, check for:

- An air leak in coolant reserve/overflow tank or its hose
- An air leak in radiator filler neck
- Leak in pressure cap seal to radiator filler neck

COOLING SYSTEM—DRAINING AND FILLING

WARNING: DO NOT REMOVE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN RADIATOR DRAINCOCK WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

DO NOT WASTE reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

DRAINING

- (1) Remove radiator pressure cap.
- (2) Loosen radiator petcock.
- (3) Remove cylinder block drain plugs. Refer to (Fig. 31) (Fig. 32) (Fig. 33).

REFILLING

NOTE: This procedure does not apply to the 4.7L engine.

Clean cooling system prior to refilling. Refer to Cooling System Cleaning section of this group.

- (1) Install cylinder block drain plugs. Coat the threads with Mopar[®] Thread Sealant with Teflon.
- (2) Close radiator petcock.
- (3) Fill cooling system with a 50/50 mixture of water and antifreeze. Be sure that antifreeze contains Alugard 340-2 [™] as specified in Coolant section of this group.

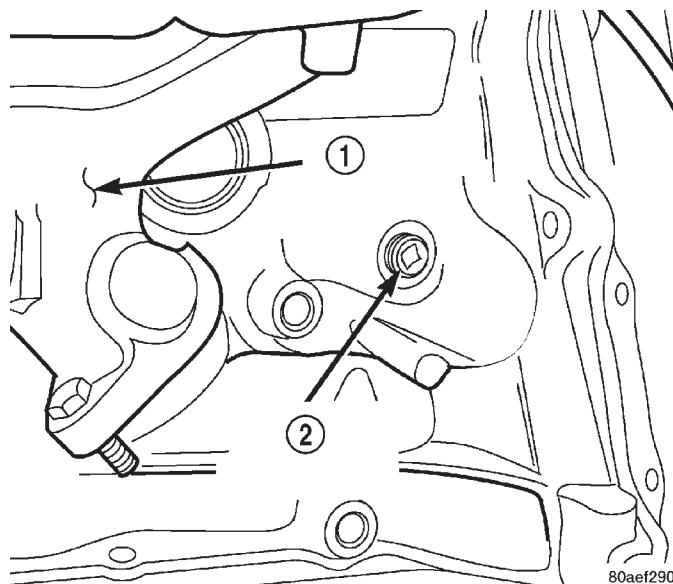


Fig. 31 Cylinder Block Drain Plug—2.5L Engine

- 1 - EXHAUST MANIFOLD
2 - CYLINDER BLOCK COOLANT DRAIN PLUG

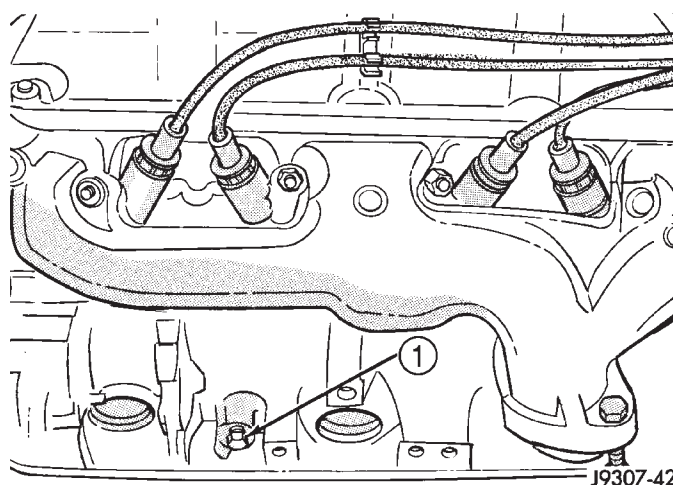


Fig. 32 Cylinder Block Drain Plug—3.9L/5.9L Engines—Typical

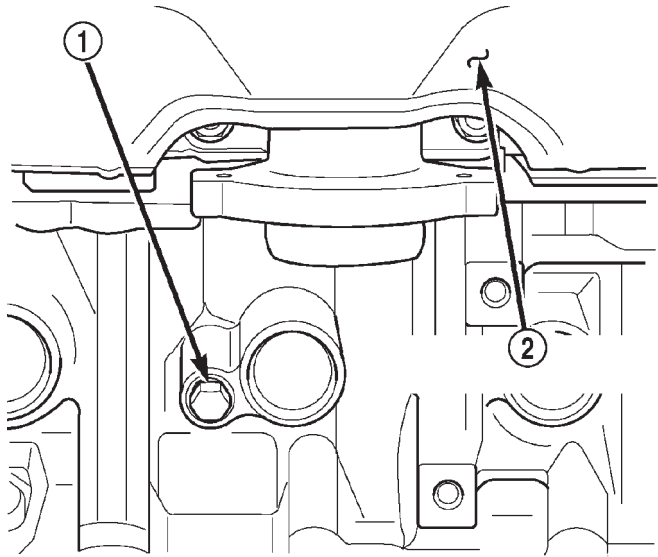
- 1 - BLOCK DRAIN PLUG

(4) Fill coolant reserve/overflow tank to FULL mark on indicator stick.

(5) Start and operate engine until thermostat opens (upper radiator hose warm to touch).

(6) If necessary, add a 50/50 water and antifreeze mixture to the coolant reserve/overflow tank. This is done to maintain coolant level between the FULL and ADD marks. The level in the reserve/overflow tank may drop below the ADD mark after three or four warm-up and cool-down cycles.

SERVICE PROCEDURES (Continued)



80b8990c

**Fig. 33 Cylinder Block Drain Plug—4.7L Engine—
Typical**

- 1 – CYLINDER BLOCK DRAIN PLUG
2 – EXHAUST MANIFOLD AND HEAT SHIELD

REFILLING 4.7L ENGINE

CAUTION: Failure to follow the procedure outlined below, can result in engine overheating conditions and sever damage to engine.

- (1) Tighten the radiator draincock and the cylinder block drain plug(s) (if removed).
- (2) Fill system using a 50/50 mixture of ethylene-glycol antifreeze and low mineral content water.
- (3) Fill coolant reservoir to FULL mark.
- (4) Install radiator cap and reservoir cap.
- (5) Start engine and run at 3000 RPM for 10 seconds.
- (6) Shut engine off.
- (7) Remove radiator cap.
- (8) Fill radiator to full level.
- (9) Install the radiator cap.

COOLING SYSTEM—CLEANING/REVERSE FLUSHING

CLEANING

Drain cooling system and refill with water. Run engine with radiator cap installed until upper radiator hose is hot. Stop engine and drain water from system. If water is dirty, fill system with water, run engine and drain system. Repeat until water drains clean.

REVERSE FLUSHING

Reverse flushing of cooling system is the forcing of water through the cooling system. This is done using air pressure in the opposite direction of normal coolant flow. It is usually only necessary with very dirty systems with evidence of partial plugging.

REVERSE FLUSHING RADIATOR

Disconnect radiator hoses from radiator inlet and outlet. Attach a section of radiator hose to radiator bottom outlet fitting and insert flushing gun. Connect a water supply hose and air supply hose to flushing gun.

CAUTION: Internal radiator pressure must not exceed 138 kPa (20 psi) as damage to radiator may result.

Allow radiator to fill with water. When radiator is filled, apply air in short blasts. Allow radiator to refill between blasts. Continue this reverse flushing until clean water flows out through rear of radiator cooling tube passages. Have radiator cleaned more extensively by a radiator repair shop.

REVERSE FLUSHING ENGINE

Drain cooling system. Remove thermostat housing and thermostat. Install thermostat housing. Disconnect radiator upper hose from radiator and attach flushing gun to hose. Disconnect radiator lower hose from water pump and attach a lead-away hose to water pump inlet fitting.

CAUTION: On vehicles equipped with a heater water control valve, be sure heater control valve is closed (heat off). This will prevent coolant flow with scale and other deposits from entering heater core.

Connect water supply hose and air supply hose to flushing gun. Allow engine to fill with water. When engine is filled, apply air in short blasts, allowing system to fill between air blasts. Continue until clean water flows through the lead away hose.

Remove lead away hose, flushing gun, water supply hose and air supply hose. Remove thermostat housing and install thermostat. Install thermostat housing with a replacement gasket. Refer to Thermostat Replacement. Connect radiator hoses. Refill cooling system with correct antifreeze/water mixture. Refer to Refilling the Cooling System.

CHEMICAL CLEANING

In some instances, use a radiator cleaner (Mopar Radiator Kleen or equivalent) before flushing. This will soften scale and other deposits and aid flushing operation.

CAUTION: Follow manufacturers instructions when using these products.

SERVICE PROCEDURES (Continued)

COOLANT

DESCRIPTION

ETHYLENE-GLYCOL MIXTURES

CAUTION: Richer antifreeze mixtures cannot be measured with normal field equipment and can cause problems associated with 100 percent ethylene-glycol.

The required ethylene-glycol (antifreeze) and water mixture depends upon the climate and vehicle operating conditions. The recommended mixture of 50/50 ethylene-glycol and water will provide protection against freezing to -37 deg. C (-35 deg. F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. **If percentage is lower than 44 percent, engine parts may be eroded by cavitation, and cooling system components may be severely damaged by corrosion.** Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to -67.7 deg. C (-90 deg. F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because the specific heat of antifreeze is lower than that of water.

Use of 100 percent ethylene-glycol will cause formation of additive deposits in the system, as the corrosion inhibitive additives in ethylene-glycol require the presence of water to dissolve. The deposits act as insulation, causing temperatures to rise to as high as 149 deg. C (300 deg. F). This temperature is hot enough to melt plastic and soften solder. The increased temperature can result in engine detonation. In addition, 100 percent ethylene-glycol freezes at 22 deg. C (-8 deg. F).

PROPYLENE-GLYCOL MIXTURES

Its overall effective temperature range is smaller than that of ethylene-glycol. The freeze point of 50/50 propylene-glycol and water is -32 deg. C (-26 deg. F). 5 deg. C higher than ethylene-glycol's freeze point. The boiling point (protection against summer boil-over) of propylene-glycol is 125 deg. C (257 deg. F) at 96.5 kPa (14 psi), compared to 128 deg. C (263 deg. F) for ethylene-glycol. Use of propylene-glycol can result in boil-over or freeze-up on a cooling system designed for ethylene-glycol. Propylene glycol also has poorer heat transfer characteristics than ethylene glycol. This can increase cylinder head temperatures under certain conditions.

Propylene-glycol/ethylene-glycol Mixtures can cause the destabilization of various corrosion inhibitors, causing damage to the various cooling system components. Also, once ethylene-glycol and propy-

lene-glycol based coolants are mixed in the vehicle, conventional methods of determining freeze point will not be accurate. Both the refractive index and specific gravity differ between ethylene glycol and propylene glycol.

OPERATION

ETHYLENE-GLYCOL MIXTURES

Coolant flows through the engine block absorbing the heat from the engine, then flows to the radiator where the cooling fins in the radiator transfers the heat from the coolant to the atmosphere. During cold weather the ethylene-glycol coolant prevents water present in the cooling system from freezing within temperatures indicated by mixture ratio of coolant to water.

COOLANT SELECTION AND ADDITIVES

The presence of aluminum components in the cooling system requires strict corrosion protection. Maintain coolant at specified level with a mixture of ethylene-glycol based antifreeze and water. Daimler-Chrysler Corporation recommends Mopar Antifreeze or equivalent. If coolant becomes contaminated or loses color, drain and flush cooling system and fill with correctly mixed solution.

CAUTION: Do not use coolant additives that are claimed to improve engine cooling.

REMOVAL AND INSTALLATION

COOLANT RESERVE/OVERFLOW TANK

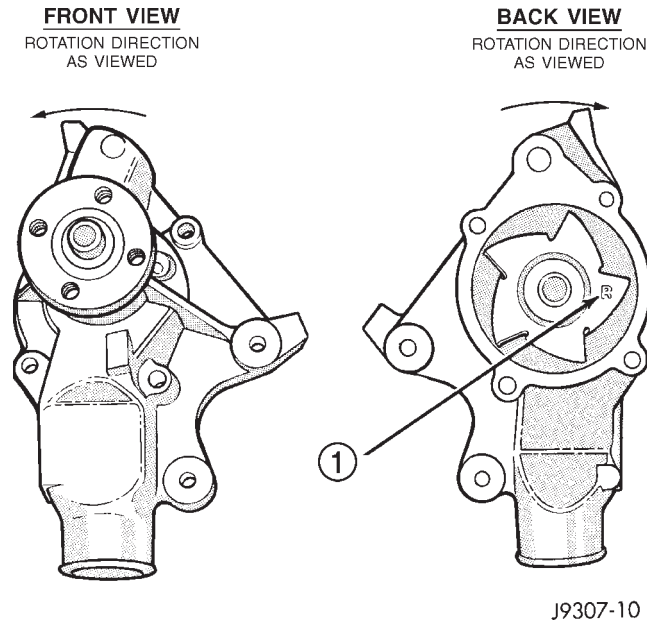
NOTE: The coolant reservoir/overflow tank is integral to the upper fan shroud. Refer to Fan Shroud in this section for proper removal/installation procedures.

WATER PUMP—2.5L ENGINE

REMOVAL

CAUTION: The 2.5L engine has a reverse (counterclockwise) rotating water pump. The letter R is stamped into the back of the water pump impeller (Fig. 34) to identify. Engines from previous model years, depending upon application, may be equipped with a forward (clockwise) rotating water pump. Installation of the wrong water pump will cause engine over heating.

REMOVAL AND INSTALLATION (Continued)

**Fig. 34 Reverse Rotating Water Pump—Typical**

1 - R STAMPED INTO IMPELLER

The water pump can be removed without discharging the air conditioning system (if equipped).

The water pump impeller is pressed on the rear of the pump shaft and bearing assembly. The water pump is serviced only as a complete assembly.

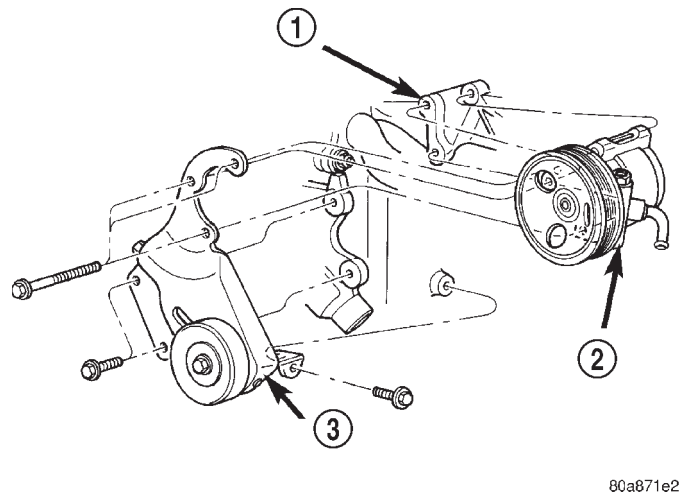
WARNING: DO NOT REMOVE THE BLOCK DRAIN PLUG(S) OR LOOSEN RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

DO NOT WASTE reusable coolant. If the solution is clean, drain coolant into a clean container for reuse.

- (1) Disconnect the battery negative cable.
- (2) Drain the cooling system.
- (3) Remove the accessory drive belt.
- (4) Remove power steering pump (Fig. 35), refer to Group 19 Steering for the correct procedure.

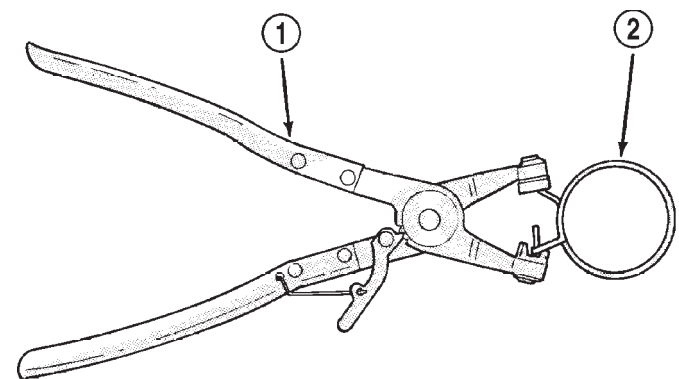
WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 36) SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 37). If

**Fig. 35 Power Steering Pump Attachment**

- 1 - INTAKE MANIFOLD
- 2 - PUMP ASSEMBLY 2.5L
- 3 - PUMP BRACKET

replacement is necessary, use only an original equipment clamp with matching number or letter.



J9207-36

Fig. 36 Hose Clamp Tool—Typical

- 1 - HOSE CLAMP TOOL 6094
- 2 - HOSE CLAMP

(5) Remove lower radiator hose from water pump. Remove heater hose from water pump fitting.

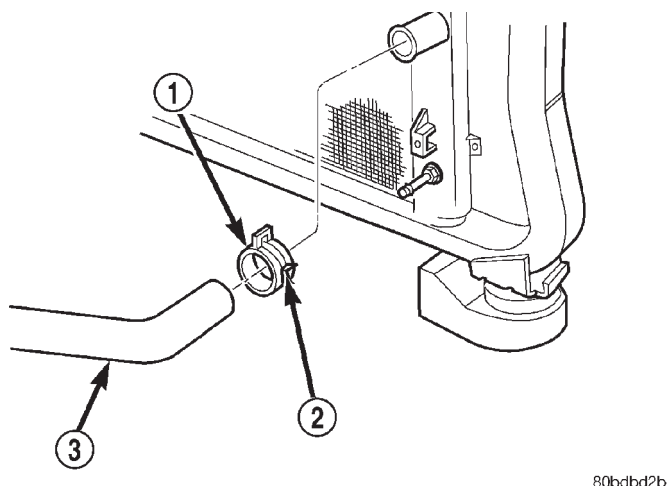
(6) Remove the four pump mounting bolts (Fig. 38) and remove pump from vehicle. Discard old gasket. Note that one of the four bolts is longer than the other bolts.

(7) If pump is to be replaced, the heater hose fitting must be removed and transferred to the new pump. Note position of fitting before removal.

INSTALLATION

(1) If pump is being replaced, install the heater hose fitting to the pump. Use a sealant on the fitting

REMOVAL AND INSTALLATION (Continued)

**Fig. 37 Clamp Number/Letter Location**

- 1 - CONSTANT TENSION HOSE CLAMP
 2 - CLAMP NUMBER/LETTER LOCATION
 3 - HOSE

such as Mopar™ Thread Sealant With Teflon. Refer to the directions on the package.

(2) Clean the gasket mating surfaces. If the original pump is used, remove any deposits or other foreign material. Inspect the cylinder block and water pump mating surfaces for erosion or damage from cavitation.

(3) Install the gasket and water pump. The silicone bead on the gasket should be facing the water pump. Also, the gasket is installed dry. Tighten mounting bolts to 30 N·m (22 ft. lbs.) torque. Rotate the shaft by hand to be sure it turns freely.

(4) Connect the radiator and heater hoses to the water pump.

(5) Position water pump pulley to water pump hub.

(6) Install power steering pump.

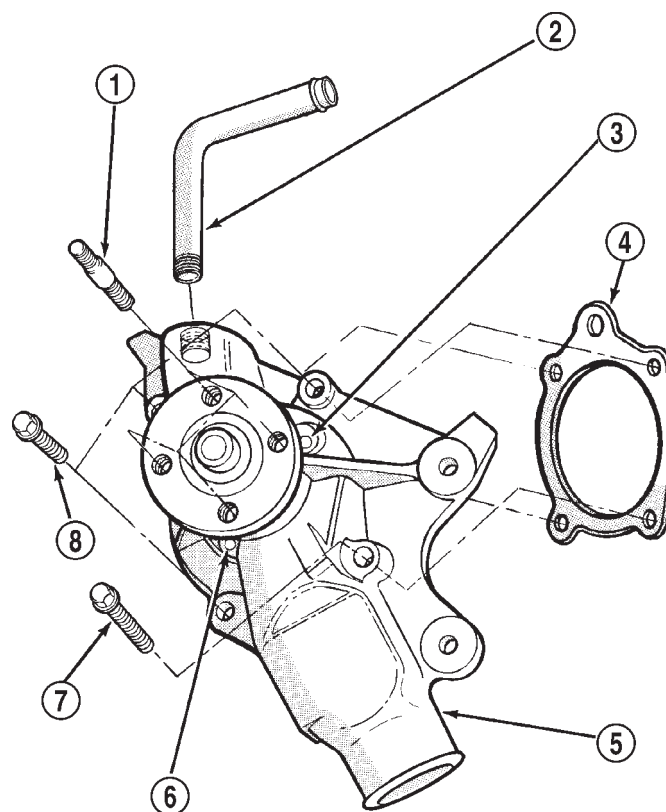
CAUTION: When installing the serpentine accessory drive belt, the belt **MUST** be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction. Refer to the Belt Removal and Installation in this group for appropriate belt routing. You may also refer to the Belt Routing Label in the vehicle engine compartment.

(7) Adjust accessory drive belt, refer to Accessory Drive Belt removal and installation in this group.

(8) Fill cooling system with coolant and check for leaks. Refer to Refilling Cooling System in this group.

(9) Connect battery negative cable.

(10) Start and warm the engine. Check for leaks.

**Fig. 38 Water Pump Remove/Install—Typical**

- 1 - (4) PULLEY MOUNTING STUDS
 2 - HEATER HOSE FITTING
 3 - UPPER VENT HOLE
 4 - PUMP GASKET
 5 - WATER PUMP
 6 - LOWER VENT HOLE
 7 - LONG BOLT
 8 - BOLTS (3) SHORT

WATER PUMP—3.9L/5.9L ENGINES**REMOVAL**

The water pump can be removed and installed without discharging the air conditioning system (if equipped).

(1) Disconnect battery negative cable.

(2) Drain cooling system. Refer to Cooling System—Draining and Filling in this group.

(3) Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

REMOVAL AND INSTALLATION (Continued)

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 36). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 37). If replacement is necessary, use only an original equipment clamp with matching number or letter.

(4) Remove upper radiator hose clamp and hose at radiator.

(5) The thermal viscous fan drive is attached (threaded) to the water pump hub shaft (Fig. 40). Remove fan/viscous fan drive assembly from water pump by turning mounting nut counterclockwise as viewed from front. Threads on viscous fan drive are **RIGHT HAND**. A Snap-On 36 MM Fan Wrench (number SP346 from Snap-On Cummins Diesel Tool Set number 2017DSP) and Special Tool 6958 Spanner Wrench with Adapter Pins 8346 can be used. Place Special Tool 6958 Spanner Wrench onto the water pump pulley with Adapter Pins 8346 inserted into the holes on the pulley (Fig. 39) to prevent pulley from rotating. Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

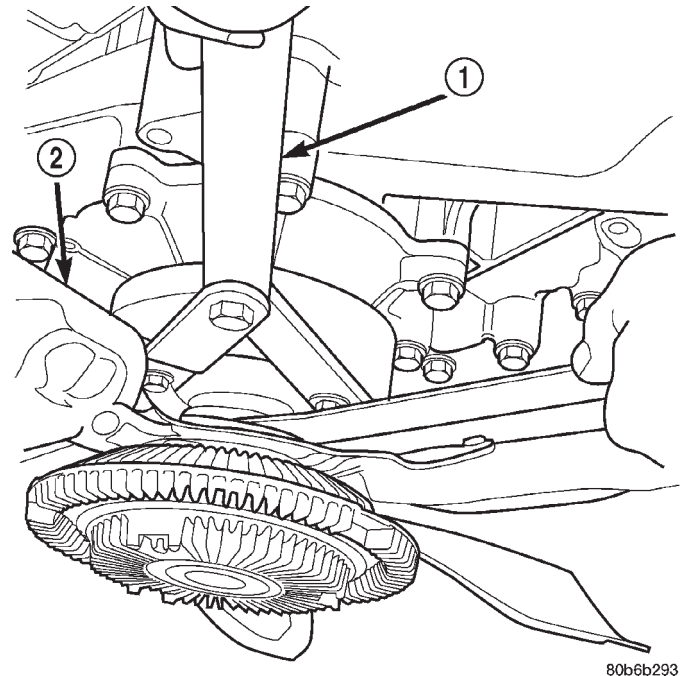
(6) If water pump is being replaced, do not unbolt fan blade assembly (Fig. 40) from thermal viscous fan drive.

(7) Remove fan shroud attaching hardware (two bolts at bottom-two clips at top).

(8) Remove fan shroud and fan blade/viscous fan drive assembly from vehicle as a complete unit.

(9) After removing fan blade/viscous fan drive assembly, **do not** place thermal viscous fan drive in horizontal position. If stored horizontally, silicone fluid in viscous fan drive could drain into its bearing assembly and contaminate lubricant.

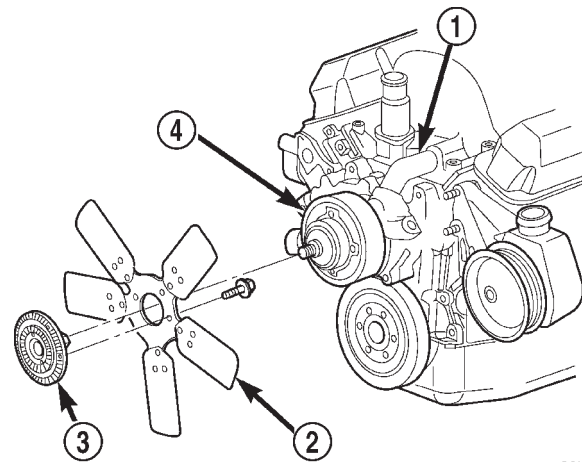
(10) Remove accessory drive belt as follows: The drive belt is equipped with a spring loaded automatic tensioner (Fig. 41). Relax tension from belt by rotating tensioner clockwise (as viewed from front) (Fig. 41). When all belt tension has been relaxed, remove accessory drive belt.



80b6b293

Fig. 39 Viscous Fan Drive Removal / Installation

- 1 - SPECIAL TOOL 6958 SPANNER WRENCH WITH ADAPTER PINS 8346
- 2 - FAN



80bdbd2c

Fig. 40 Fan Blade and Viscous Fan Drive—3.9L/5.9L Engines

- 1 - WATER PUMP BYPASS HOSE
- 2 - FAN BLADE ASSEMBLY
- 3 - VISCIOUS FAN DRIVE
- 4 - WATER PUMP AND PULLEY

REMOVAL AND INSTALLATION (Continued)

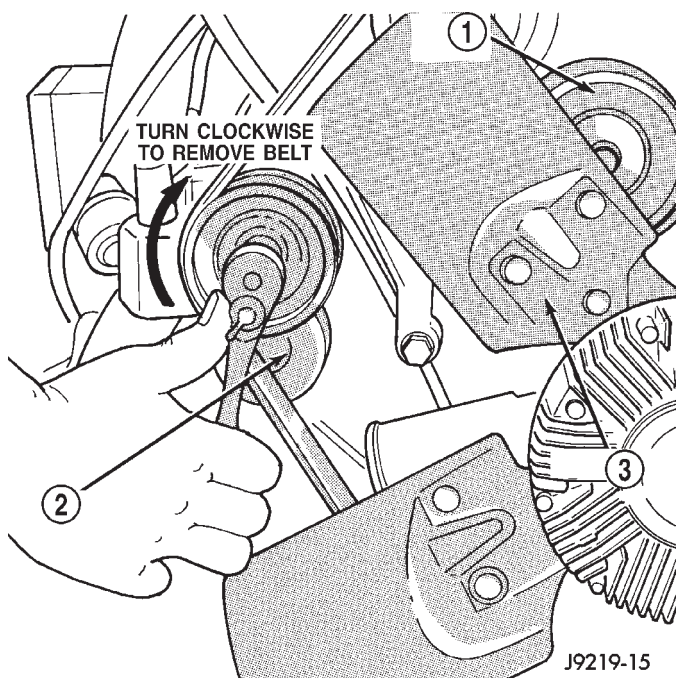


Fig. 41 Automatic Belt Tensioner Assembly—3.9L/5.9L Engines

- 1 - IDLER PULLEY
- 2 - TENSIONER
- 3 - FAN BLADE

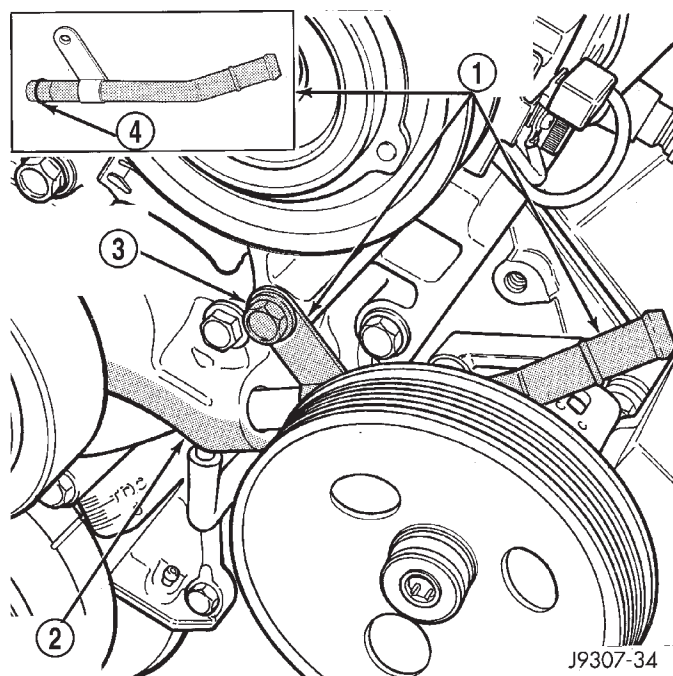


Fig. 42 Coolant Return Tube—3.9L/5.9L Engines—Typical

- 1 - COOLANT RETURN TUBE
- 2 - WATER PUMP
- 3 - TUBE MOUNTING BOLT
- 4 - O-RING

(11) Remove lower radiator hose clamp and remove lower hose at water pump.

(12) Remove heater hose clamp and heater hose from heater hose coolant return tube.

(13) Loosen heater hose coolant return tube mounting bolt (Fig. 42) and remove tube from water pump. Discard the old tube O-ring.

(14) Remove seven water pump mounting bolts.

(15) Loosen clamp at water pump end of bypass hose (Fig. 40). Slip bypass hose from water pump while removing pump from vehicle. Discard old gasket.

CAUTION: Do not pry water pump at timing chain case/cover. The machined surfaces may be damaged resulting in leaks.

INSTALLATION

(1) Clean gasket mating surfaces.

(2) Using a new gasket, install water pump to engine as follows: Guide water pump nipple into bypass hose as pump is being installed. Install water pump bolts. Tighten water pump mounting bolts to 40 N·m (30 ft. lbs.) torque.

(3) Position bypass hose clamp to bypass hose.

(4) Spin water pump to be sure that pump impeller does not rub against timing chain case/cover.

(5) Install a new O-ring to the heater hose coolant return tube (Fig. 42). Coat the new O-ring with anti-freeze before installation.

(6) Install coolant return tube and its mounting bolt to engine (Fig. 42). Be sure the slot in tube bracket is bottomed to mounting bolt. This will properly position return tube.

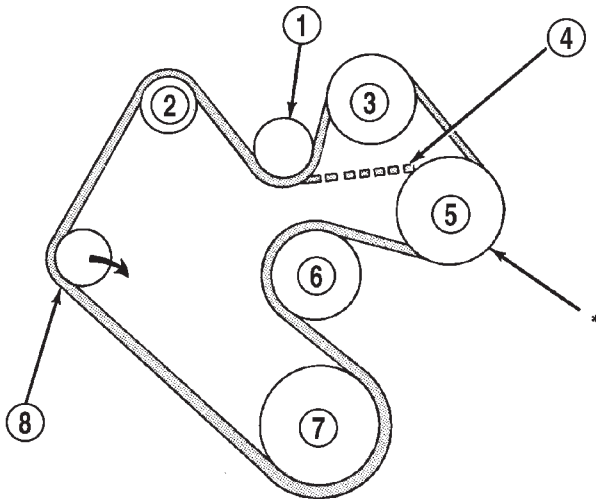
(7) Connect radiator lower hose to water pump.

(8) Connect heater hose and hose clamp to coolant return tube.

(9) Relax tension from belt tensioner (Fig. 41). Install accessory drive belt.

CAUTION: When installing the serpentine accessory drive belt, the belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 43) for correct belt routing. The correct belt with correct length must be used.

REMOVAL AND INSTALLATION (Continued)



*IF VEHICLE IS NOT EQUIPPED WITH POWER STEERING, THIS WILL BE AN IDLER PULLEY.

J9307-26

Fig. 43 Belt Routing—3.9L/5.9L Engines

- 1 - IDLER PULLEY
- 2 - GEN.
- 3 - A/C COMP.
- 4 - IF W/OUT A/C
- 5 - PWR. STRG. PUMP
- 6 - WAT. PUMP
- 7 - CRANK PULLEY
- 8 - AUTOMATIC TENSIONER

(10) Position fan shroud and fan blade/viscous fan drive assembly to vehicle as a complete unit.

(11) Install fan shroud.

(12) Install fan blade/viscous fan drive assembly to water pump shaft.

(13) Fill cooling system. Refer to Cooling System—Draining and Refilling in this group.

(14) Connect battery negative cable.

(15) Start and warm the engine. Check for leaks.

WATER PUMP 4.7L ENGINES

The water pump on 4.7L engines is bolted directly to the engine timing chain case/cover.

A gasket is used as a seal between the water pump and timing chain case/cover.

If water pump is replaced because of bearing/shaft damage, or leaking shaft seal, the mechanical cooling fan assembly should also be inspected. Inspect for fatigue cracks, loose blades, or loose rivets that could have resulted from excessive vibration. Replace fan if any of these conditions are found. Also check condition of the thermal viscous fan drive. Refer to Viscous Fan Drive in this group.

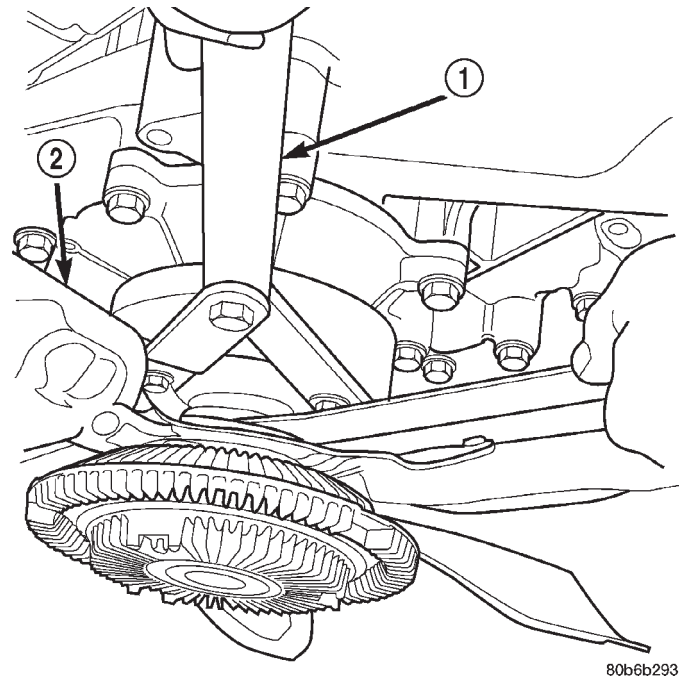
The water pump can be removed without discharging the air conditioning system (if equipped).

REMOVAL

- (1) Disconnect negative battery cable from battery.
- (2) Drain cooling system. Refer to Draining Cooling System in this group.

Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

(3) The thermal viscous fan drive is attached (threaded) to the water pump hub shaft. Remove fan/viscous fan drive assembly from water pump by turning mounting nut counterclockwise as viewed from front. Threads on viscous fan drive are **RIGHT HAND**. Using special tool spanner wrench 6958 with adapter pins 8346 and a suitable fan wrench loosen the fan drive (Fig. 44). Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.



80b6b293

Fig. 44 Viscous Fan and Fan Drive 4.7L

- 1 - SPECIAL TOOL 6958 SPANNER WRENCH WITH ADAPTER PINS 8346
- 2 - FAN

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps. If replacement is necessary, use only an original equipment clamp with matching number or letter.

REMOVAL AND INSTALLATION (Continued)

(4) If water pump is being replaced, do not unbolt fan blade assembly from thermal viscous fan drive.

(5) Remove two fan shroud-to-radiator screws (Fig. 45). Disconnect the coolant overflow hose, windshield washer fluid hose and washer pump electrical connector.

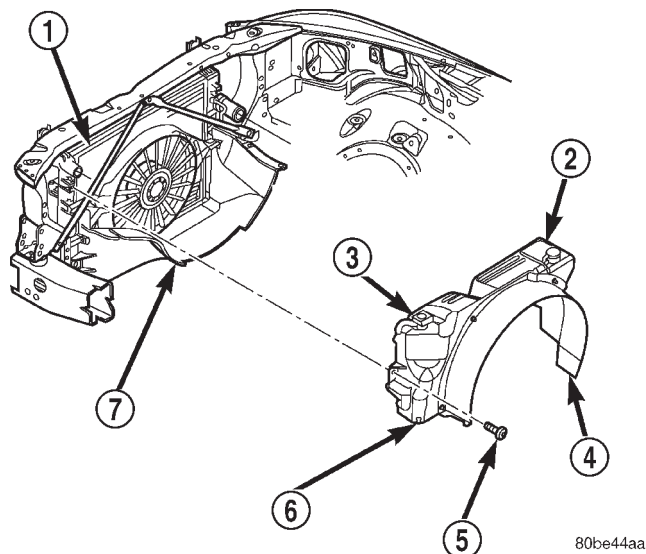


Fig. 45 Upper Fan Shroud, Coolant reservoir and Washer Fluid Reservoir

- 1 - RADIATOR
- 2 - WASHER FLUID RESERVOIR
- 3 - COOLANT OVERFLOW/RESERVOIR
- 4 - FAN SHROUD (UPPER)
- 5 - SCREW
- 6 - INTERLOCKING PINS
- 7 - FAN SHROUD (LOWER)

(6) Remove upper fan shroud and fan blade/viscous fan drive assembly from vehicle.

(7) After removing fan blade/viscous fan drive assembly, **do not** place thermal viscous fan drive in horizontal position. If stored horizontally, silicone fluid in viscous fan drive could drain into its bearing assembly and contaminate lubricant.

(8) Remove accessory drive belt as follows: The drive belt is equipped with a spring loaded automatic belt tensioner. Relax tension from belt by rotating tensioner clockwise (as viewed from front) (Fig. 46). When all belt tension has been relaxed, remove accessory drive belt.

(9) Remove lower radiator hose clamp and remove lower hose at water pump.

(10) Remove seven water pump mounting bolts and one stud bolt.

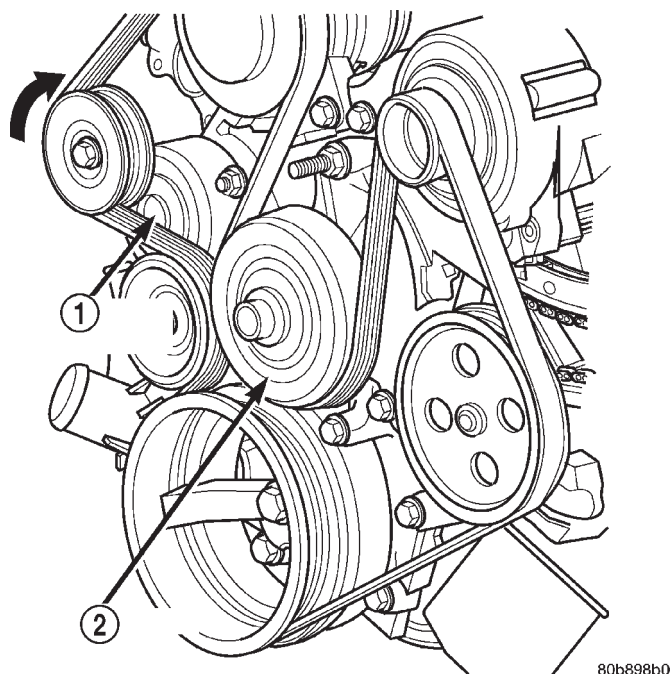


Fig. 46 Automatic Belt Tensioner—4.7L

- 1 - AUTOMATIC TENSIONER
- 2 - WATER PUMP PULLEY

CAUTION: Do not pry water pump at timing chain case/cover. The machined surfaces may be damaged resulting in leaks.

(11) Remove water pump and gasket. Discard gasket.

INSTALLATION

(1) Clean gasket mating surfaces.

(2) Using a new gasket, position water pump and install mounting bolts as shown. (Fig. 47). Tighten water pump mounting bolts to 54 N·m (40 ft. lbs.) torque.

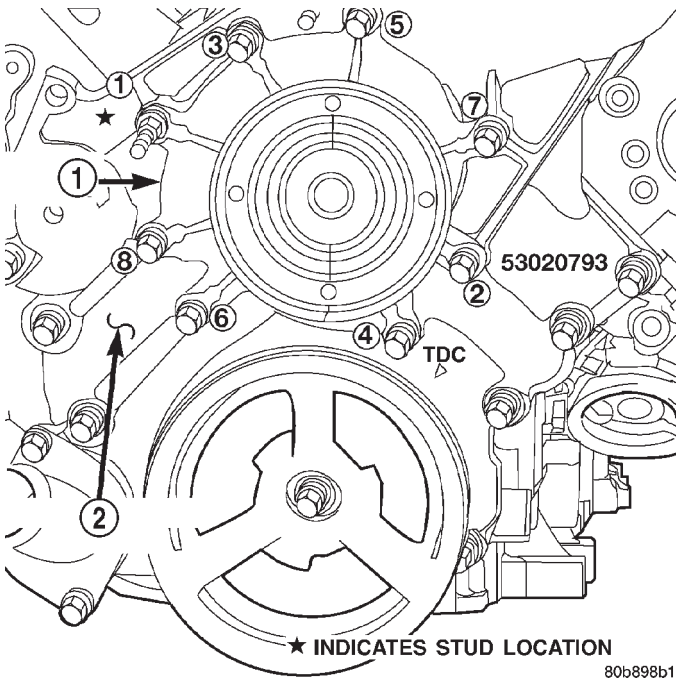
(3) Spin water pump to be sure that pump impeller does not rub against timing chain case/cover.

(4) Connect radiator lower hose to water pump.

(5) Relax tension from belt tensioner (Fig. 46). Install drive belt.

CAUTION: When installing the serpentine accessory drive belt, belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 48) for correct belt routing. Or, refer to the Belt Routing Label located in the engine compartment. The correct belt with correct length must be used.

REMOVAL AND INSTALLATION (Continued)

**Fig. 47 Water Pump Installation—4.7L**

- 1 - WATER PUMP
- 2 - TIMING CHAIN COVER

(6) Position upper fan shroud and fan blade/viscous fan drive assembly.

(7) Be sure the upper and lower portions of the fan shroud are firmly connected. All air must flow through the radiator.

(8) Install two fan shroud-to-radiator screws (Fig. 45).

(9) Be sure of at least 25 mm (1.0 inches) between tips of fan blades and fan shroud.

(10) Install fan blade/viscous fan drive assembly to water pump shaft.

(11) Fill cooling system. Refer to Refilling the Cooling System in this group.

(12) Connect negative battery cable.

(13) Start and warm the engine. Check for leaks.

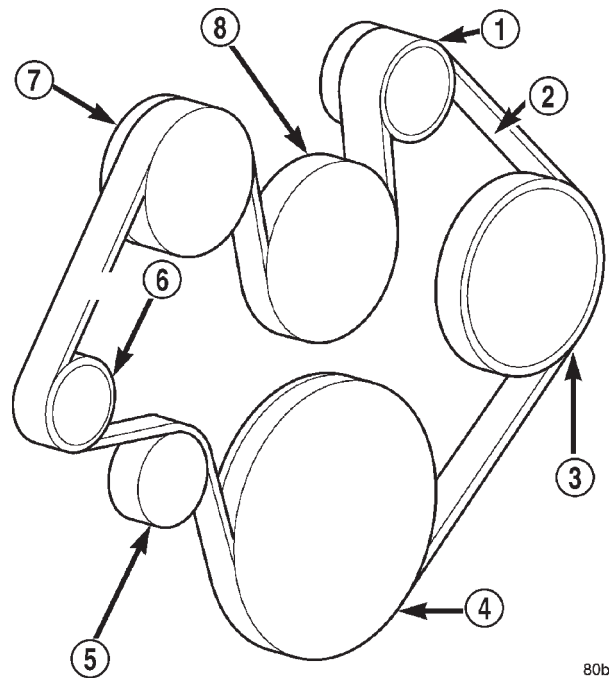
WATER PUMP BYPASS HOSE—3.9/5.9L ENGINES

REMOVAL WITHOUT AIR CONDITIONING

(1) Partially drain cooling system. Refer to Draining Cooling System in this group.

Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL (NUMBER

**Fig. 48 Belt Routing 4.7L**

- 1 - GENERATOR
- 2 - ACCESSORY DRIVE BELT
- 3 - POWER STEERING PUMP PULLEY
- 4 - CRANKSHAFT PULLEY
- 5 - IDLER PULLEY
- 6 - TENSIONER PULLEY
- 7 - A/C COMPRESSOR PULLEY
- 8 - WATER PUMP PULLEY

6094) (Fig. 49). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 50). If replacement is necessary, use only an original equipment clamp with matching number or letter.

(2) Loosen both bypass hose clamps (Fig. 49) and position to center of hose. Remove hose from vehicle.

INSTALLATION

(1) Position bypass hose clamps (Fig. 49) to center of hose.

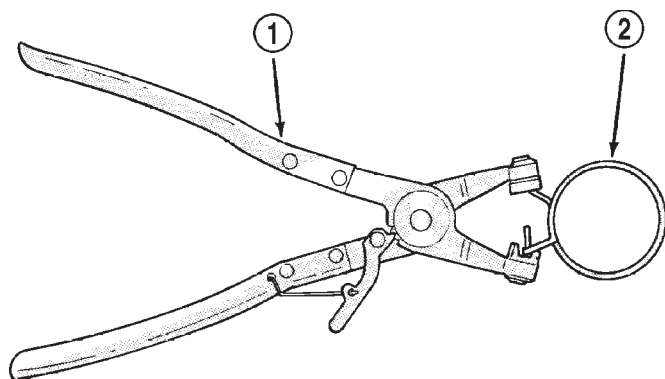
(2) Install bypass hose to engine.

(3) Secure both hose clamps (Fig. 49).

(4) Fill cooling system. Refer to Refilling the Cooling System in this group.

(5) Start and warm the engine. Check for leaks.

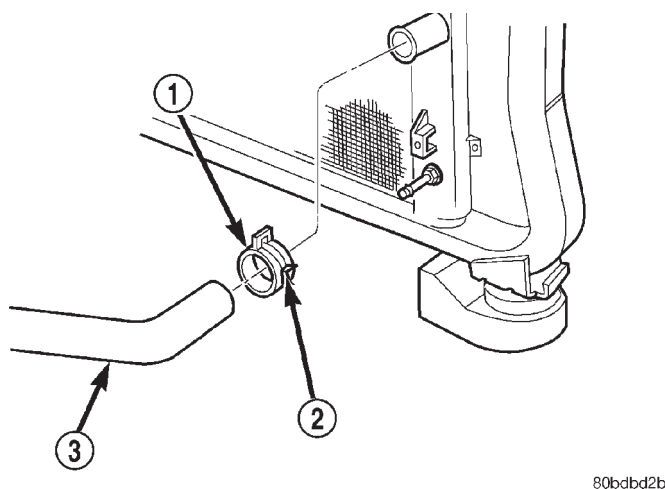
REMOVAL AND INSTALLATION (Continued)



J9207-36

Fig. 49 Hose Clamp Tool—Typical

- 1 - HOSE CLAMP TOOL 6094
- 2 - HOSE CLAMP

**Fig. 50 Clamp Number/Letter Location**

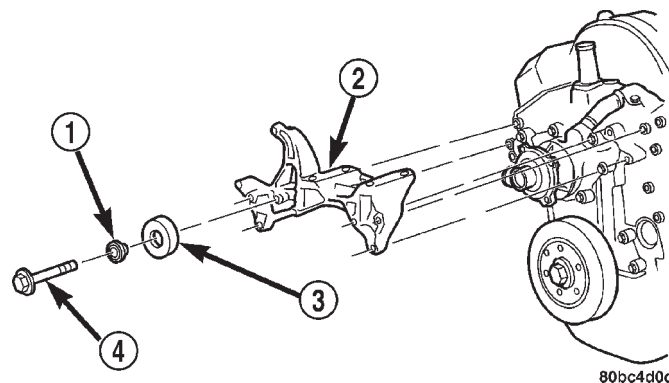
- 1 - CONSTANT TENSION HOSE CLAMP
- 2 - CLAMP NUMBER/LETTER LOCATION
- 3 - HOSE

REMOVAL WITH AIR CONDITIONING

If equipped with A/C, the generator and A/C compressor along with their common mounting bracket (Fig. 51) must be partially removed. Removing generator or A/C compressor from their mounting bracket is not necessary. Also, discharging A/C system is not necessary. **Do not** remove any refrigerant lines from A/C compressor.

WARNING: THE A/C SYSTEM IS UNDER PRESSURE EVEN WITH ENGINE OFF. REFER TO REFRIGERANT WARNINGS IN GROUP 24, HEATING AND AIR CONDITIONING.

- (1) Disconnect battery negative cable.

**Fig. 51 Generator—A/C Compressor Mounting Bracket—3.9/5.9L Engine**

- 1 - IDLER PULLEY BUSHING
- 2 - A/C AND/OR GENERATOR MOUNTING BRACKET
- 3 - IDLER PULLEY
- 4 - SCREW AND WASHER

- (2) Partially drain cooling system. Refer to Cooling System—Draining and Filling in this group.

Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

- (3) Remove upper radiator hose clamp (Fig. 49) and hose at radiator.

- (4) Unplug wiring harness from A/C compressor.

- (5) Remove air cleaner assembly.

- (6) Remove accessory drive belt as follows: The drive belt is equipped with a spring loaded automatic tensioner (Fig. 52). Relax tension from belt by rotating tensioner clockwise (as viewed from front) (Fig. 52). When all belt tension has been relaxed, remove accessory drive belt.

- (7) The drive belt idler pulley must be removed to gain access to one of A/C compressor/generator bracket mounting bolts. Remove idler pulley bolt and remove idler pulley (Fig. 51).

- (8) Remove oil dipstick tube mounting bolt at side of A/C-generator mounting bracket.

- (9) Disconnect throttle body control cables. Refer to Accelerator Pedal and Throttle Cable in Group 14, Fuel System.

- (10) Remove heater hose clamp and heater hose from heater hose coolant return tube.

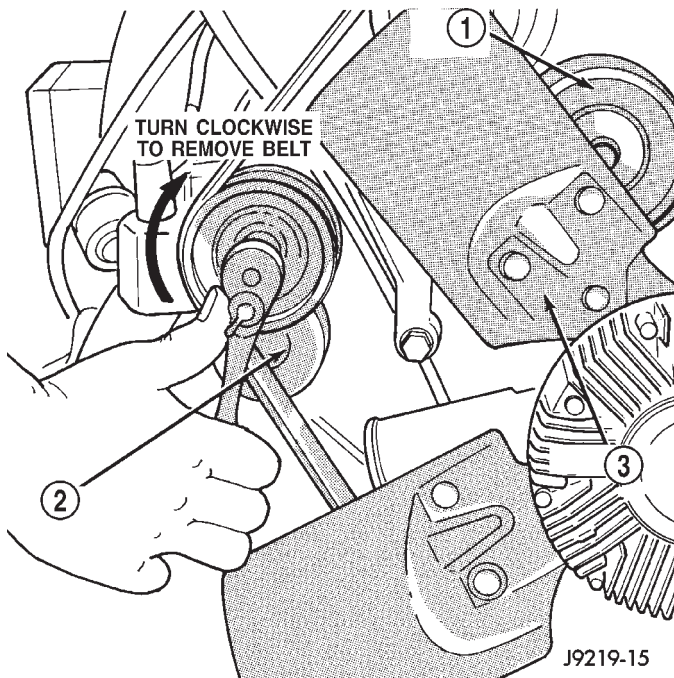
- (11) Remove heater hose coolant return tube mounting bolt (Fig. 53) and remove tube from engine. Discard the old tube O-ring.

- (12) Remove bracket-to-intake manifold bolts (number 1 and 2— (Fig. 51).

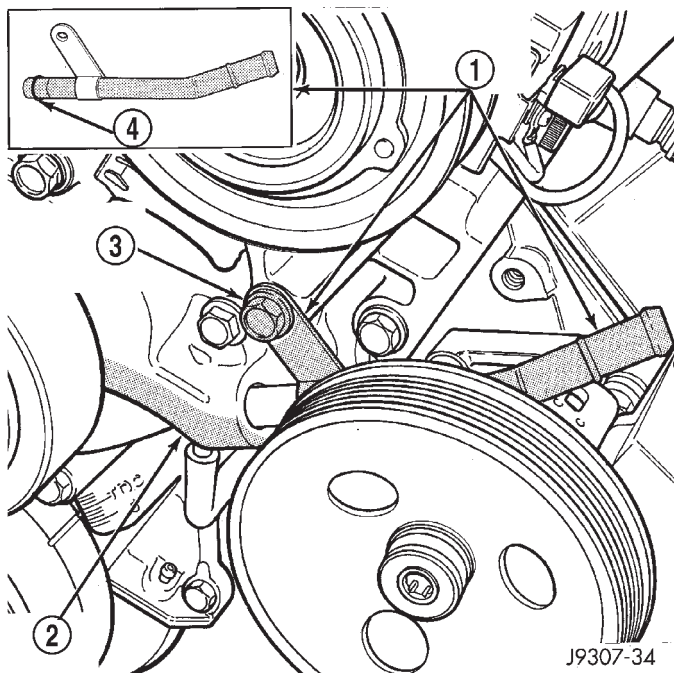
- (13) Remove six bracket bolts (number 3— (Fig. 51).

- (14) Lift and position generator and A/C compressor (along with their common mounting bracket) to gain access to bypass hose. A block of wood may be used to hold assembly in position.

REMOVAL AND INSTALLATION (Continued)

**Fig. 52 Automatic Belt Tensioner Assembly**

- 1 - IDLER PULLEY
- 2 - TENSIONER
- 3 - FAN BLADE

**Fig. 53 Coolant Return Tube—3.9/5.9L Engines—Typical**

- 1 - COOLANT RETURN TUBE
- 2 - WATER PUMP
- 3 - TUBE MOUNTING BOLT
- 4 - O-RING

(15) Loosen and position both hose clamps to center of bypass hose. Remove hose from vehicle.

INSTALLATION

- (1) Position bypass hose clamps to center of hose.
- (2) Install bypass hose to engine.
- (3) Secure both hose clamps (Fig. 49).
- (4) Install generator-A/C mounting bracket assembly to engine. Tighten bolts (number 1 and 2— (Fig. 51) to 54 N·m (40 ft. lbs.) torque. Tighten bolts (number 3— (Fig. 51) to 40 N·m (30 ft. lbs.) torque.
- (5) Install a new O-ring to the heater hose coolant return tube (Fig. 53). Coat the new O-ring with anti-freeze before installation.
- (6) Install coolant return tube and its mounting bolt to engine (Fig. 53).
- (7) Connect throttle body control cables.
- (8) Install oil dipstick mounting bolt.
- (9) Install idler pulley. Tighten bolt to 54 N·m (40 ft. lbs.) torque.
- (10) Relax tension from belt tensioner (Fig. 52). Install drive belt.

CAUTION: When installing serpentine accessory drive belt, the belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 54) for correct belt routing. The correct belt with correct length must be used.

- (11) Install air cleaner assembly.
- (12) Install upper radiator hose to radiator.
- (13) Connect wiring harness to A/C compressor.
- (14) Connect battery negative cable.
- (15) Fill cooling system. Refer to Refilling the Cooling System in this group.
- (16) Start and warm the engine. Check for leaks.

THERMOSTAT—3.9L/5.9L ENGINES**REMOVAL**

WARNING: DO NOT LOOSEN RADIATOR DRAIN-CK WITH SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM COOLANT CAN OCCUR.

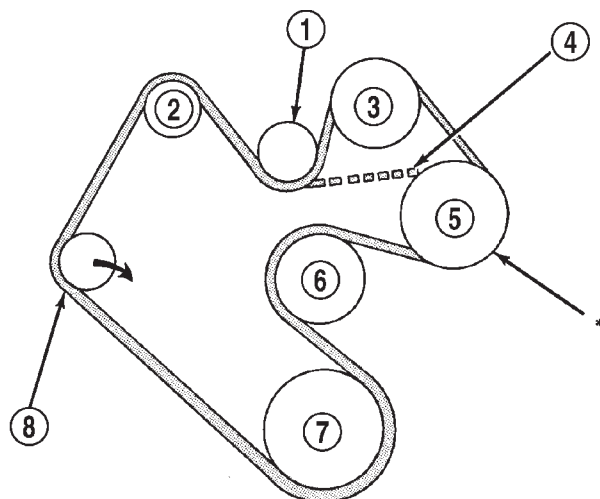
Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

If thermostat is being replaced, be sure that replacement is specified thermostat for vehicle model and engine type.

Factory installed thermostat housings on 3.9L/5.9L engines are installed on a gasket with an anti-stick coating. This will aid in gasket removal and clean-up.

- (1) Disconnect negative battery cable at battery.

REMOVAL AND INSTALLATION (Continued)



*IF VEHICLE IS NOT EQUIPPED WITH POWER STEERING, THIS WILL BE AN IDLER PULLEY.

J9307-26

Fig. 54 Belt Routing—3.9/5.9L Engines

- 1 - IDLER PULLEY
- 2 - GEN.
- 3 - A/C COMP.
- 4 - IF W/OUT A/C
- 5 - PWR. STRG. PUMP
- 6 - WAT. PUMP
- 7 - CRANK PULLEY
- 8 - AUTOMATIC TENSIONER

(2) Drain cooling system until coolant level is below thermostat. Refer to Draining Cooling System in this group.

(3) Air Conditioned vehicles: Remove support bracket (generator mounting bracket-to-intake manifold) located near rear of generator (Fig. 55).

(4) On air conditioning equipped vehicles, the generator must be partially removed.

(a) Remove generator drive belt as follows: Drive belts on both 3.9L and 5.9L engines are equipped with a spring loaded automatic belt tensioner (Fig. 56).

(b) Attach a socket/wrench to pulley mounting bolt of automatic tensioner (Fig. 56).

(c) Rotate tensioner assembly clockwise (as viewed from front) until tension has been relieved from belt.

(d) Remove belt from vehicle.

(e) Remove two generator mounting bolts. Do not remove any wiring at generator. If equipped with 4WD, unplug 4WD indicator lamp wiring harness (located near rear of generator).

(f) Remove generator. Position generator to gain access for thermostat gasket removal.

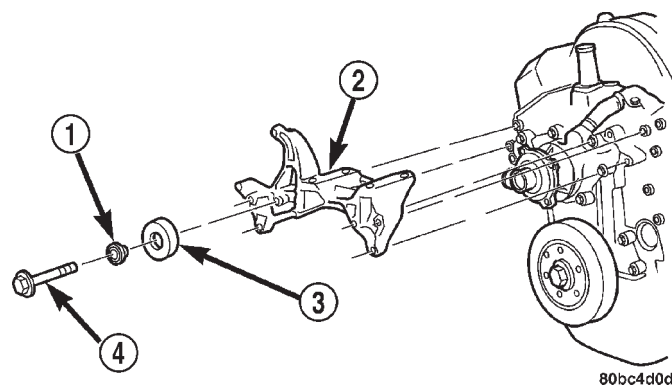


Fig. 55 Generator Support Bracket—3.9L/5.9L Engine

- 1 - IDLER PULLEY BUSHING
- 2 - A/C AND/OR GENERATOR MOUNTING BRACKET
- 3 - IDLER PULLEY
- 4 - SCREW AND WASHER

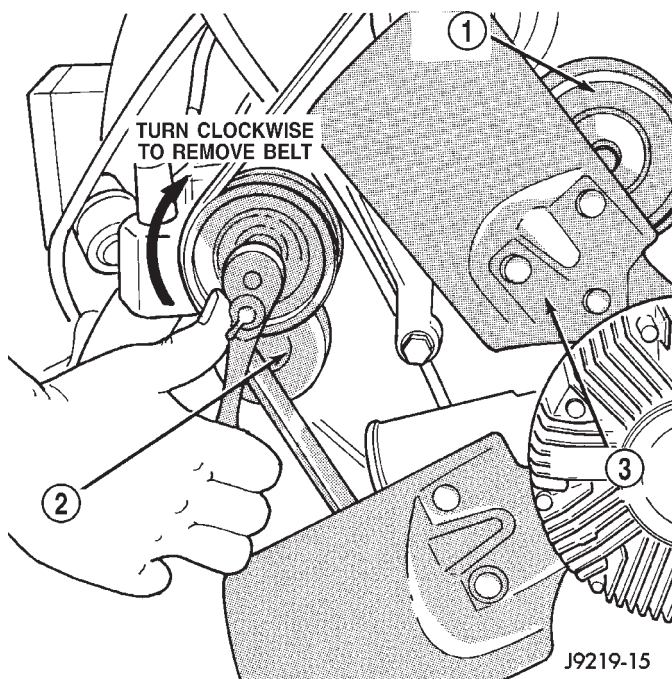


Fig. 56 Automatic Belt Tensioner—3.9L/5.9L Engines

- 1 - IDLER PULLEY
- 2 - TENSIONER
- 3 - FAN BLADE

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 36). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

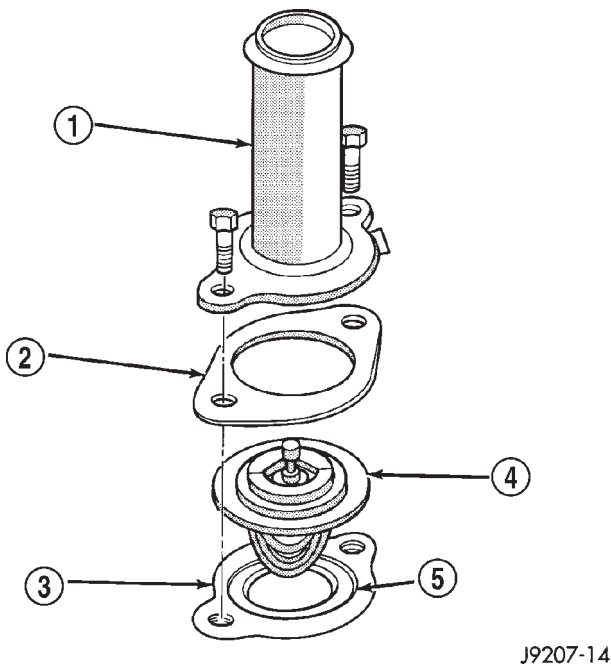
REMOVAL AND INSTALLATION (Continued)

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 37). If replacement is necessary, use only an original equipment clamp with matching number or letter.

(5) Remove upper radiator hose clamp and upper radiator hose at thermostat housing.

(6) Position wiring harness (behind thermostat housing) to gain access to thermostat housing.

(7) Remove thermostat housing mounting bolts, thermostat housing, gasket and thermostat (Fig. 57). Discard old gasket.



J9207-14

Fig. 57 Thermostat—3.9L/5.9L Engines

- 1 - THERMOSTAT HOUSING
- 2 - GASKET
- 3 - INTAKE MANIFOLD
- 4 - THERMOSTAT
- 5 - MACHINED GROOVE

INSTALLATION

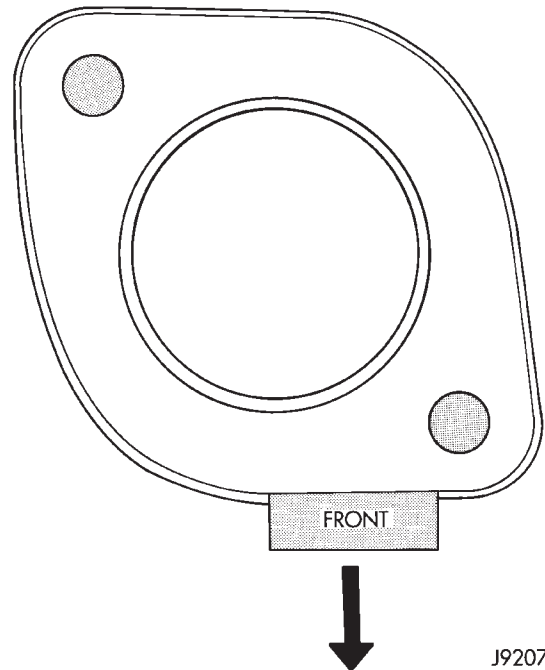
(1) Clean mating areas of intake manifold and thermostat housing.

(2) Install thermostat (spring side down) into recessed machined groove on intake manifold (Fig. 57).

(3) Install gasket on intake manifold and over thermostat (Fig. 57).

(4) Position thermostat housing to intake manifold. Note the word **FRONT** stamped on housing (Fig. 58). For adequate clearance, this **must** be placed towards front of vehicle. The housing is slightly angled forward after installation to intake manifold.

(5) Install two housing-to-intake manifold bolts. Tighten bolts to 23 N·m (200 in. lbs.) torque.



J9207-13

Fig. 58 Thermostat Position—3.9L/5.9L Engines

(6) Install upper radiator hose to thermostat housing.

(7) Air Conditioned vehicles:

CAUTION: When installing the serpentine accessory drive belt, the belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 59) for correct 3.9/5.2L engine belt routing. The correct belt with correct length must be used.

(a) Install generator. Tighten bolts to 41 N·m (30 ft. lbs.).

(b) Install support bracket (generator mounting bracket-to-intake manifold) (Fig. 55). Tighten bolts to 54 N·m (40 ft. lbs.) torque.

(c) Position drive belt over all pulleys **except** idler pulley (located between generator and A/C compressor).

(d) Attach a socket/wrench to pulley mounting bolt of automatic tensioner (Fig. 56).

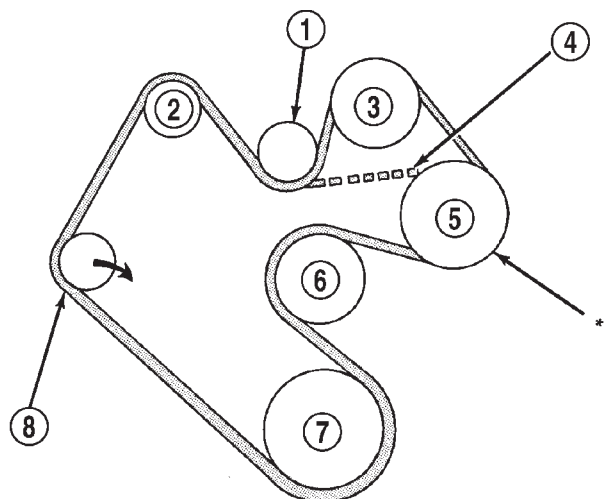
(e) Rotate socket/wrench clockwise. Place belt over idler pulley. Let tensioner rotate back into place. Remove wrench. Be sure belt is properly seated on all pulleys.

(8) Fill cooling system. Refer to Refilling Cooling System in this group.

(9) Connect battery negative cable.

(10) Start and warm the engine. Check for leaks.

REMOVAL AND INSTALLATION (Continued)



*IF VEHICLE IS NOT EQUIPPED WITH POWER STEERING, THIS WILL BE AN IDLER PULLEY.

J9307-26

Fig. 59 Belt Routing—3.9L/5.9L Engines

- 1 - IDLER PULLEY
- 2 - GEN.
- 3 - A/C COMP.
- 4 - IF W/OUT A/C
- 5 - PWR. STRG. PUMP
- 6 - WAT. PUMP
- 7 - CRANK PULLEY
- 8 - AUTOMATIC TENSIONER

THERMOSTAT—2.5L ENGINE

REMOVAL

WARNING: DO NOT LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

DO NOT WASTE reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

- (1) Disconnect battery negative cable.
- (2) Drain the coolant from the radiator until the level is below the thermostat housing.
- (3) Remove radiator upper hose and heater hose at thermostat housing.
- (4) Disconnect wiring connector at engine coolant temperature sensor.
- (5) Remove thermostat housing mounting bolts, thermostat housing, gasket and thermostat (Fig. 60). Discard old gasket.
- (6) Clean the gasket mating surfaces.

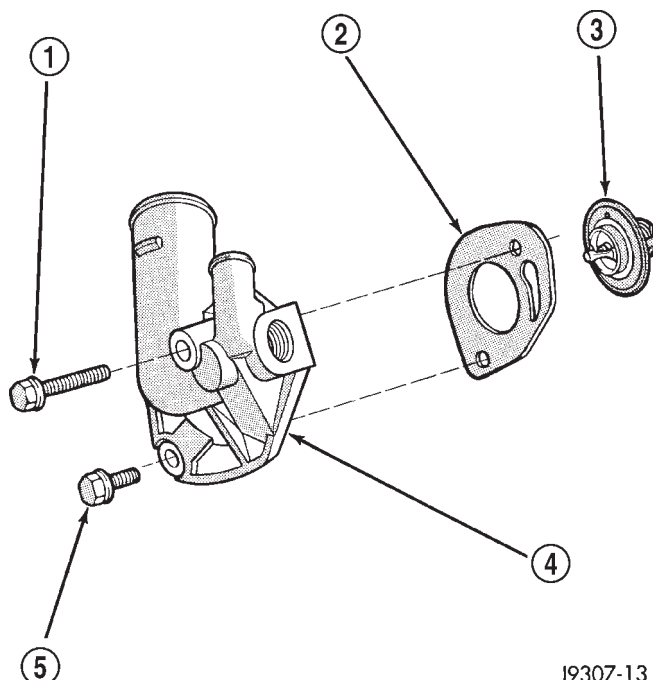


Fig. 60 2.5L Thermostat Removal/Installation

- 1 - LONG BOLT
- 2 - GASKET
- 3 - THERMOSTAT
- 4 - THERMOSTAT HOUSING
- 5 - SHORT BOLT

J9307-13

INSTALLATION

(1) Install the replacement thermostat so that the pellet, which is encircled by a coil spring, faces the engine. All thermostats are marked on the outer flange to indicate the proper installed position.

(a) Observe the recess groove in the engine cylinder head (Fig. 61).

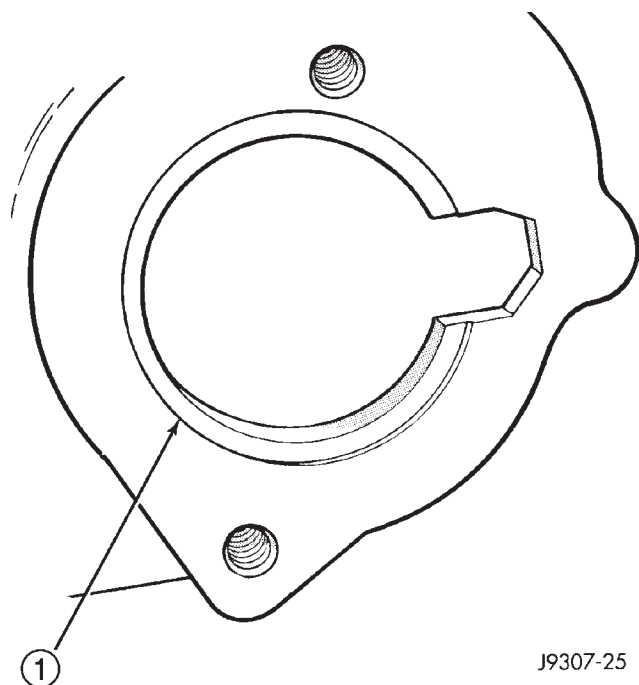
(b) Position thermostat into this groove with arrow and air bleed hole on outer flange pointing up.

(2) Install replacement gasket and thermostat housing.

CAUTION: Tightening the thermostat housing unevenly or with the thermostat out of its recess may result in a cracked housing.

- (3) Tighten the housing bolts to 20 N·m (15 ft. lbs.) torque.
- (4) Install hoses to thermostat housing.
- (5) Install electrical connector to coolant temperature sensor.
- (6) Connect battery negative cable.
- (7) Be sure that the radiator draincock is tightly closed. Fill the cooling system to the correct level with the required coolant mixture. Refer to Cooling System—Draining and Refilling in this group.
- (8) Start and warm the engine. Check for leaks.

REMOVAL AND INSTALLATION (Continued)



J9307-25

Fig. 61 Thermostat Recess

1 - GROOVE

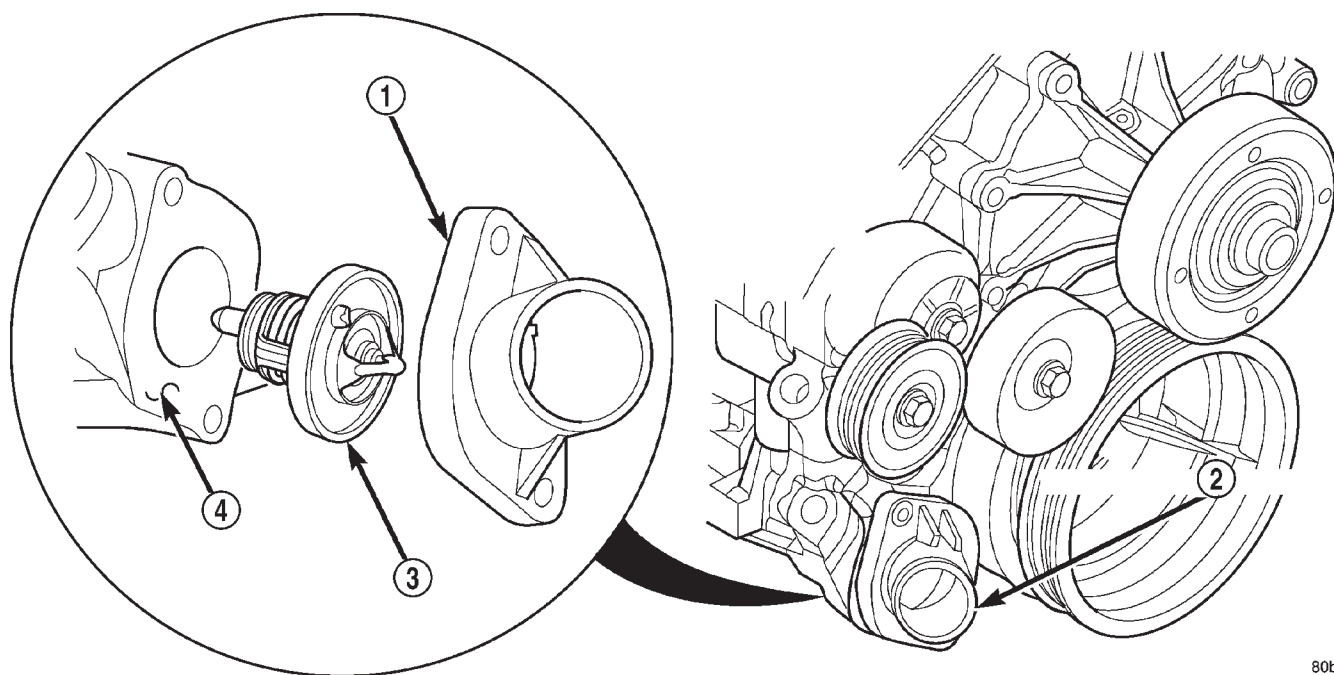
THERMOSTAT— 4.7L ENGINE**REMOVAL**

**WARNING: DO NOT LOOSEN RADIATOR DRAIN-
COCK WITH SYSTEM HOT AND PRESSURIZED.
SERIOUS BURNS FROM COOLANT CAN OCCUR.**

Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

If thermostat is being replaced, be sure that replacement is specified thermostat for vehicle model and engine type.

- (1) Disconnect negative battery cable at battery.
- (2) Drain cooling system. Refer to Draining Cooling System in this section.
- (3) Raise vehicle on hoist.
- (4) Remove splash shield.
- (5) Remove lower radiator hose clamp and lower radiator hose at thermostat housing.
- (6) Remove thermostat housing mounting bolts, thermostat housing and thermostat (Fig. 62).



80b3b198

Fig. 62 Thermostat and Thermostat Housing 4.7L

1 - THERMOSTAT HOUSING
2 - THERMOSTAT LOCATION

3 - THERMOSTAT AND GASKET
4 - TIMING CHAIN COVER

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Clean mating areas of timing chain cover and thermostat housing.

(2) Install thermostat (spring side down) into recessed machined groove on timing chain cover (Fig. 62).

(3) Position thermostat housing on timing chain cover.

(4) Install two housing-to-timing chain cover bolts. Tighten bolts to 13 N·m (115 in. lbs.) torque.

CAUTION: Housing must be tightened evenly and thermostat must be centered into recessed groove in timing chain cover. If not, it may result in a cracked housing, damaged timing chain cover threads or coolant leaks.

(5) Install lower radiator hose on thermostat housing.

(6) Install splash shield.

(7) Lower vehicle.

(8) Fill cooling system. Refer to Refilling Cooling System in this section.

(9) Connect negative battery cable to battery.

(10) Start and warm the engine. Check for leaks.

TRANSMISSION OIL COOLER LINES

REMOVAL

(1) Raise vehicle on hoist.

(2) Place a drain pan under the cooler line connections at the radiator.

(3) Disconnect the cooler lines at the radiator and the transmission.

(4) Disconnect the routing brackets.

(5) Remove two mounting nuts, power steering oil cooler and the routing bracket from two mounting studs (Fig. 63).

(6) Remove the cooler lines from the vehicle.

INSTALLATION

(1) Position the cooler lines into the vehicle.

NOTE: Transmission oil cooler lines must not contact other items other than the routing brackets, oil cooler lines resting against, or in contact with other items may cause wear, allowing cooler lines to leak.

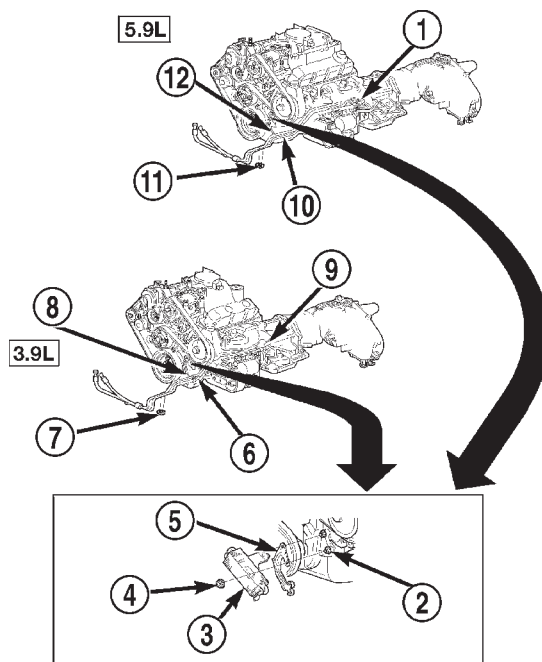
(2) Position the routing bracket over two studs then position the power steering oil cooler and install two mounting nuts (Fig. 63).

(3) Position the two remaining routing brackets.

(4) Install the cooler lines to the transmission and radiator.

(5) Lower vehicle.

(6) Start engine check for leaks.



80bcea92

**Fig. 63 Transmission Oil Cooler Lines Routing—
3.9L and 5.9L Engines**

- 1 – ROUTING BRACKET
- 2 – MOUNTING STUDS
- 3 – POWER STEERING OIL COOLER
- 4 – MOUNTING NUT
- 5 – ROUTING BRACKET
- 6 – TRANSMISSION OIL COOLER LINES
- 7 – RETAINER CLIP
- 8 – ROUTING BRACKET
- 9 – ROUTING BRACKET
- 10 – TRANSMISSION OIL COOLER LINES
- 11 – RETAINER CLIP
- 12 – ROUTING BRACKET

RADIATOR

REMOVAL

WARNING: DO NOT REMOVE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN RADIATOR DRAIN-CK WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

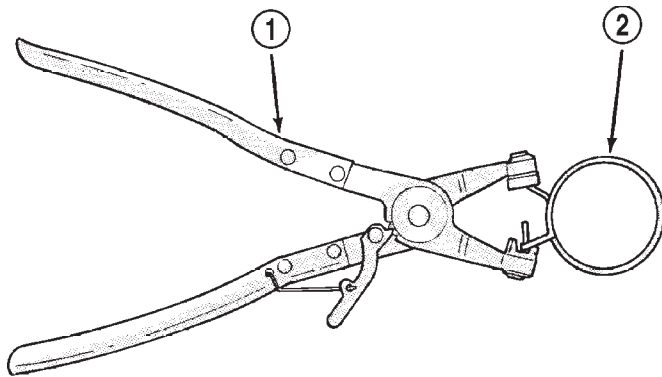
(1) Disconnect battery negative cable.

(2) Drain cooling system. Refer to Draining and Filling Cooling System in this section.

REMOVAL AND INSTALLATION (Continued)

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 64). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

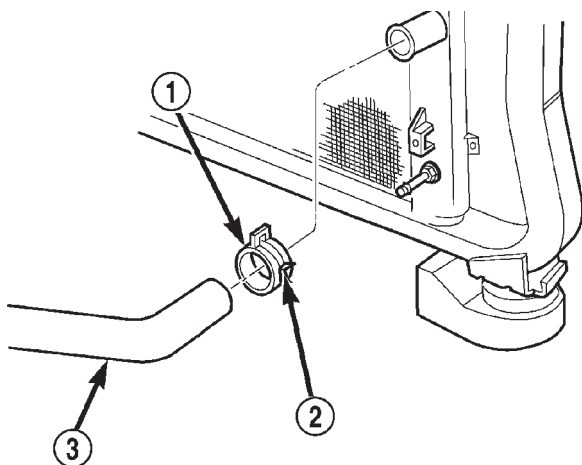
CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 65). If replacement is necessary, use only an original equipment clamp with matching number or letter.



J9207-36

Fig. 64 Hose Clamp Tool—Typical

- 1 - HOSE CLAMP TOOL 6094
2 - HOSE CLAMP



80bcbd2b

Fig. 65 Clamp Number/Letter Location

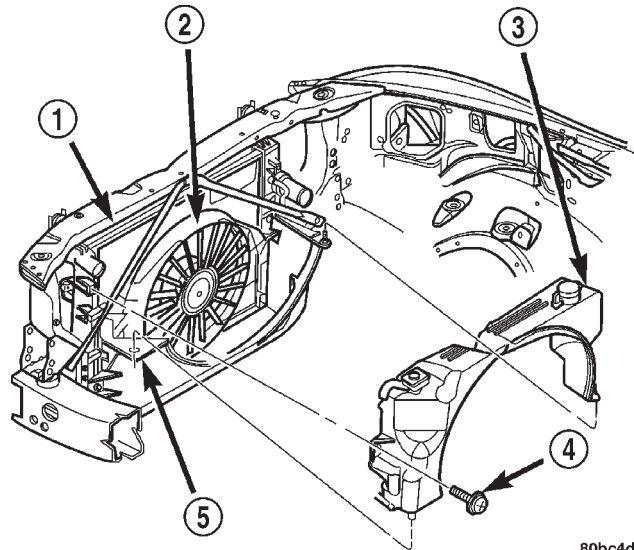
- 1 - CONSTANT TENSION HOSE CLAMP
2 - CLAMP NUMBER/LETTER LOCATION
3 - HOSE

(3) Remove hose clamps (Fig. 64) and hoses from radiator. Disconnect coolant reserve/overflow tank hose and washer bottle electrical connector and hose.

(4) Remove upper fan shroud mounting screws. Lift upper fan shroud assembly up and out of engine compartment.

(5) Disconnect electric cooling fan motor connector.

(6) Remove radiator upper mounting screws (Fig. 67). Lift radiator upward and away from vehicle. Do not allow cooling fins of radiator to contact any other vehicle component. Radiator fin damage could result.



80bc4d18

Fig. 66 Radiator Upper Fan Shroud Removal/Installation—Typical

- 1 - RADIATOR
2 - ELECTRIC COOLING FAN
3 - UPPER SHROUD AND OVERFLOW BOTTLE
4 - SCREW
5 - LOWER SHROUD

INSTALLATION

The radiator has two isolator pins on bottom of both tanks. These fit into alignment holes in radiator lower support (Fig. 67).

(1) Position isolator pins into alignment holes in radiator lower support.

(2) Install and tighten radiator mounting bolts to 23 N·m (200 in. lbs.) (Fig. 67).

(3) Connect fan motor electrical connector to harness connector.

(4) Position upper fan shroud onto lower fan shroud and radiator.

(5) Install retaining screws into shroud.

(6) Install radiator hoses. reconnect coolant reserve/overflow tank hose.

(7) Connect battery negative cable.

(8) Fill cooling system. Refer to Draining and Filling Cooling System in this section.

(9) Start and warm the engine. Check for leaks.

REMOVAL AND INSTALLATION (Continued)

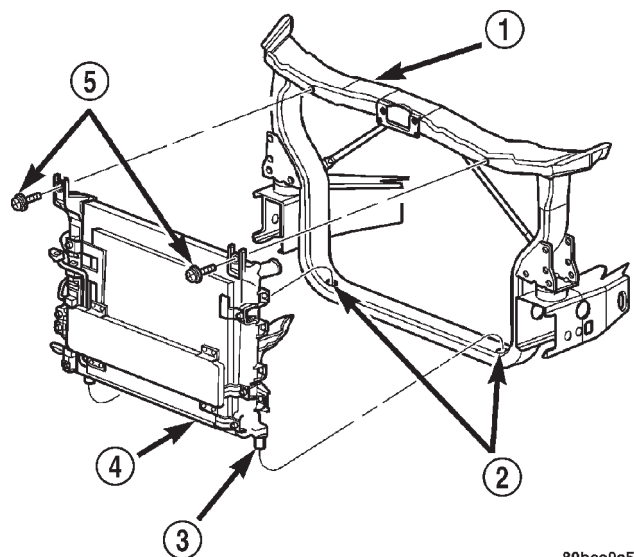


Fig. 67 Radiator Removal/Installation—Typical

80bce9a5

- 1 - CORE SUPPORT
- 2 - LOWER ISOLATOR MOUNTS
- 3 - ISOLATOR PINS
- 4 - RADIATOR ASSEMBLY
- 5 - SCREWS

ENGINE BLOCK HEATER

REMOVAL

- (1) Disconnect negative battery cable from battery.
- (2) Drain coolant from radiator and cylinder block. Refer to Draining Cooling System in this group.
- (3) Remove power cord from block heater (Fig. 68).
- (4) Loosen screw at center of block heater. Remove heater assembly.

INSTALLATION

- (1) Thoroughly clean cylinder block core hole and block heater seat.
- (2) **(all except 4.7L Engine).** Insert block heater assembly with element loop pointing down (Fig. 68).
- (3) **4.7L Engine Only,** Insert block heater assembly with element loop pointing upward (12 O'clock) (Fig. 69).
- (4) With block heater fully seated, tighten center screw to 2 N·m (17 in. lbs.) torque.
- (5) Fill cooling system with recommended coolant. Refer to Filling Cooling System section in this group.
- (6) Start and warm the engine. Check for leaks.

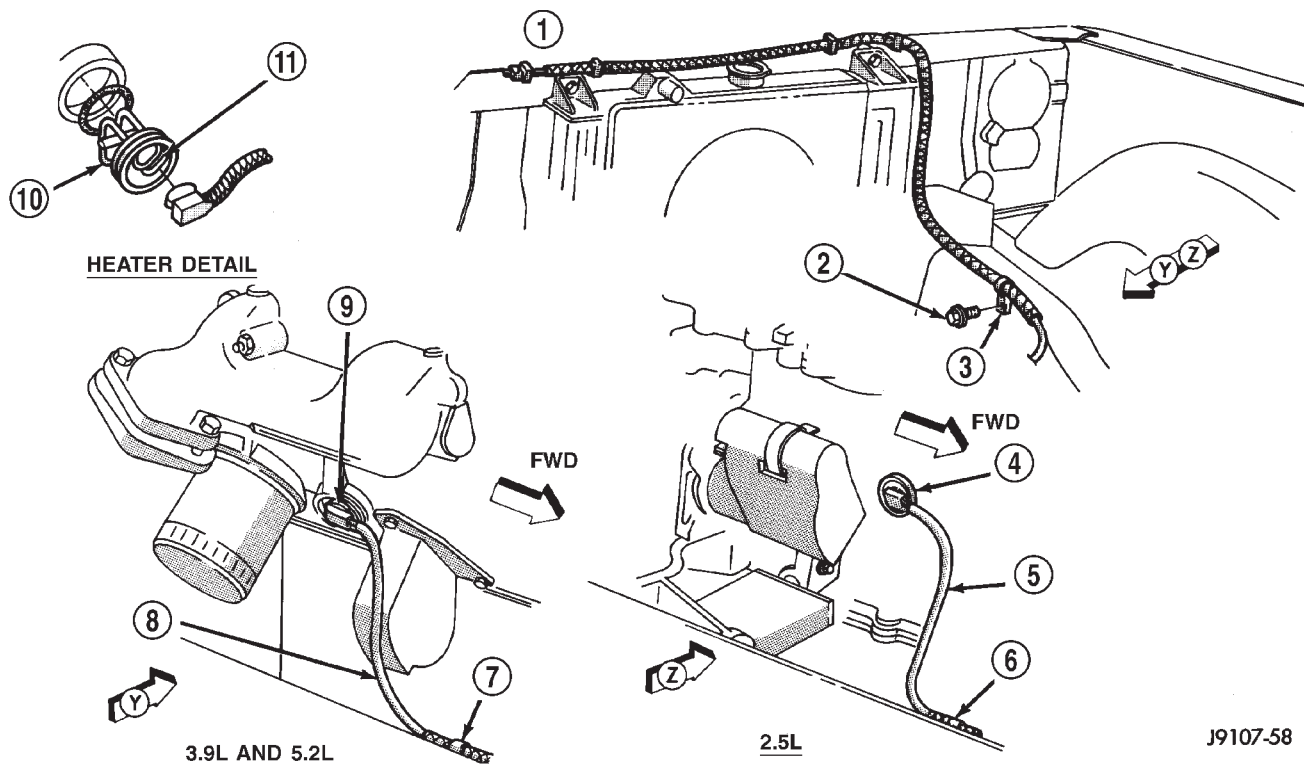


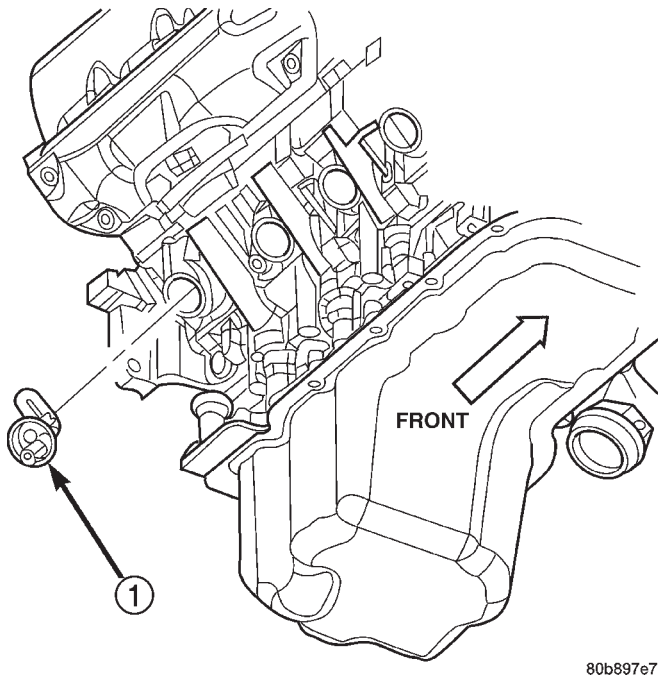
Fig. 68 Block Heater Removal/Installation

- 1 - CLIP
- 2 - SCREW 14 N·m (120 IN. LBS.)
- 3 - CLIP
- 4 - HEATER ASSEMBLY
- 5 - CORD ASSEMBLY
- 6 - CLIP

- 7 - CLIP
- 8 - CORD ASSEMBLY
- 9 - HEATER ASSEMBLY
- 10 - ELEMENT POINTS DOWN
- 11 - TIGHTEN SCREW TO SECURE HEATER

J9107-58

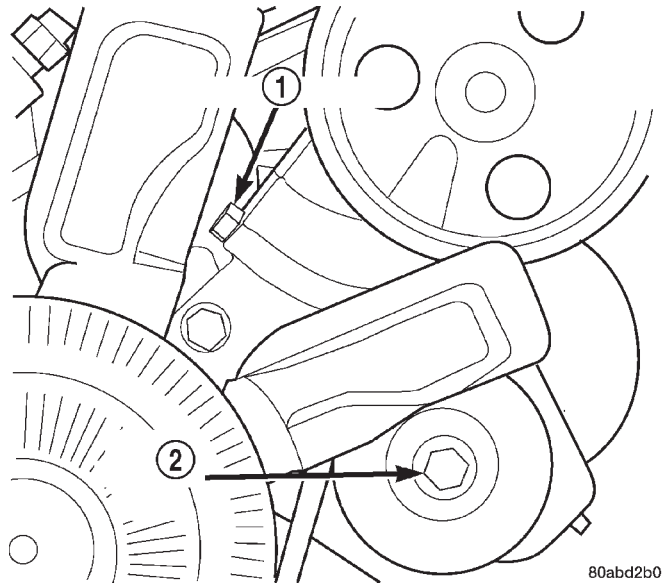
REMOVAL AND INSTALLATION (Continued)



80b897e7

Fig. 69 Engine Block Heater—4.7L

1 – ENGINE BLOCK HEATER



80abd2b0

Fig. 70 Power Steering Pump Bracket and Idler Pulley

1 – ADJUSTING BOLT

2 – IDLER PULLEY BOLT

ACCESSORY DRIVE BELT—2.5L ENGINE

REMOVAL

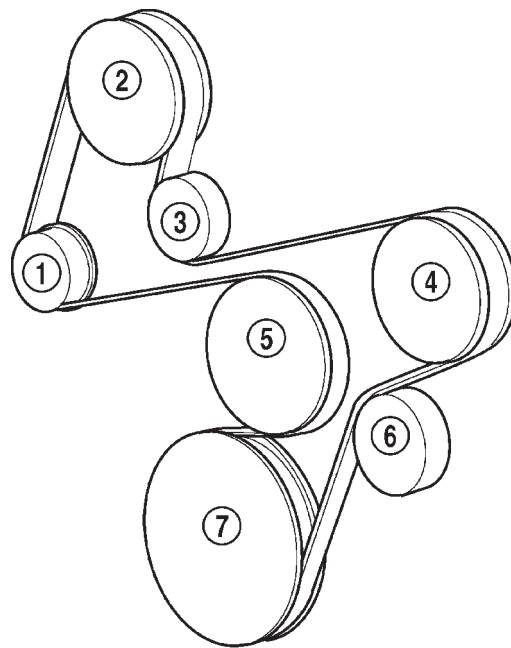
Belt tension is adjusted at the power steering pump bracket and idler pulley assembly.

- (1) Disconnect battery negative cable.
- (2) Loosen the belt tension at idler pulley (Fig. 70) by loosening the pulley center bolt and then loosening the tension adjusting bolt.
- (3) Remove accessory drive belt.

INSTALLATION

CAUTION: When installing the serpentine accessory drive belt, the belt **MUST** be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction (Fig. 71) or (Fig. 72).

- (1) Check condition of all pulleys.
- (2) Install new belt. Refer to the end of this group for Drive Belt Tension specifications. Tension belt to specification and tighten center pulley bolt (Fig. 70) to 57 N·m (42 ft. lbs.)
- (3) After power steering pump bracket and idler pulley has been tightened into position, recheck belt tension. Adjust if necessary.



80abd2ad

Fig. 71 Belt Routing—2.5L Engine With A/C

1 – GENERATOR

2 – A/C COMPRESSOR PULLEY

3 – IDLER PULLEY

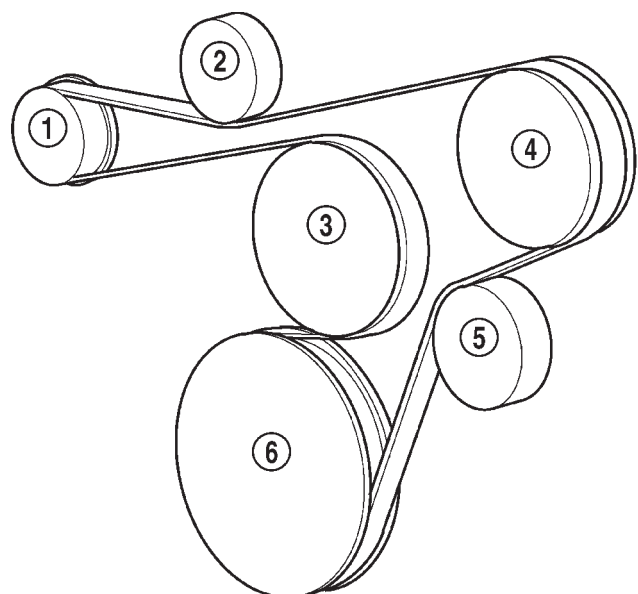
4 – POWER STEERING PUMP PULLEY

5 – WATER PUMP AND FAN PULLEY

6 – IDLER PULLEY

7 – CRANK SHAFT PULLEY

REMOVAL AND INSTALLATION (Continued)



80abd2ae

Fig. 72 Belt Routing—2.5L Engine Without A/C

- 1 - GENERATOR
- 2 - IDLER PULLEY
- 3 - WATER PUMP AND FAN PULLEY
- 4 - POWER STEERING PUMP PULLEY
- 5 - IDLER PULLEY
- 6 - CRANKSHAFT PULLEY

ACCESSORY BELT REPLACEMENT—4.7L ENGINE

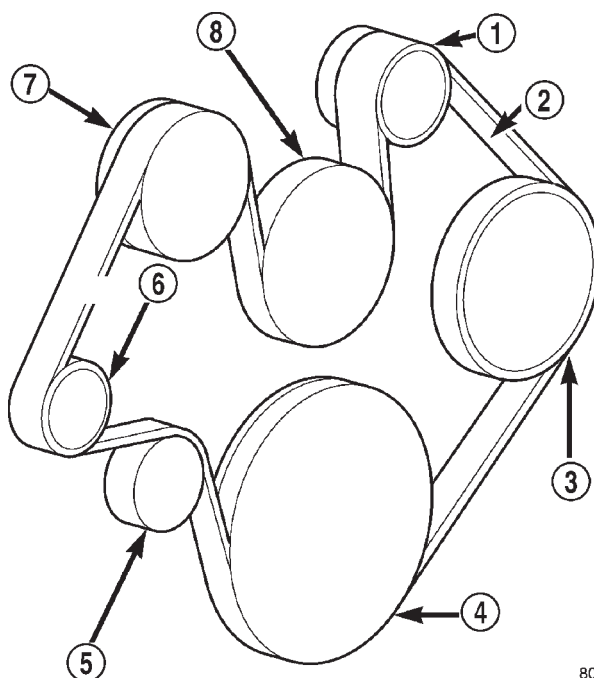
NOTE: The belt routing schematics are published from the latest information available at the time of publication. If anything differs between these schematics and the Belt Routing Label, use the schematics on Belt Routing Label. This label is located in the engine compartment.

REMOVAL

CAUTION: DO NOT LET TENSIONER ARM SNAP BACK TO THE FREEARM POSITION, SEVER DAMAGE MAY OCCUR TO THE TENSIONER.

Belt tension is not adjustable. Belt adjustment is maintained by an automatic (spring load) belt tensioner.

- (1) Disconnect negative battery cable from battery.
- (2) Rotate belt tensioner until it contacts it's stop. Remove belt, then slowly rotate the tensioner into the freearm position. (Fig. 73).



80b76f69

Fig. 73 Belt Routing—4.7L

- 1 - GENERATOR
- 2 - ACCESSORY DRIVE BELT
- 3 - POWER STEERING PUMP PULLEY
- 4 - CRANKSHAFT PULLEY
- 5 - IDLER PULLEY
- 6 - TENSIONER PULLEY
- 7 - A/C COMPRESSOR PULLEY
- 8 - WATER PUMP PULLEY

INSTALLATION

Belt tension is not adjustable. Belt adjustment is maintained by an automatic (spring load) belt tensioner.

- (1) Check condition of all pulleys.

CAUTION: When installing the serpentine accessory drive belt, the belt **MUST** be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction (Fig. 73).

- (2) Install new belt (Fig. 73). Route the belt around all pulleys except the idler pulley. Rotate the tensioner arm until it contacts it's stop position. Route the belt around the idler and slowly let the tensioner rotate into the belt. Make sure the belt is seated onto all pulleys.

- (3) With the drive belt installed, inspect the belt wear indicator (Fig. 74). On 4.7L Engines only, the gap between the tang and the housing stop (measurement A) must not exceed 24 mm (.94 inches). If the measurement exceeds this specification replace the serpentine accessory drive belt.

REMOVAL AND INSTALLATION (Continued)

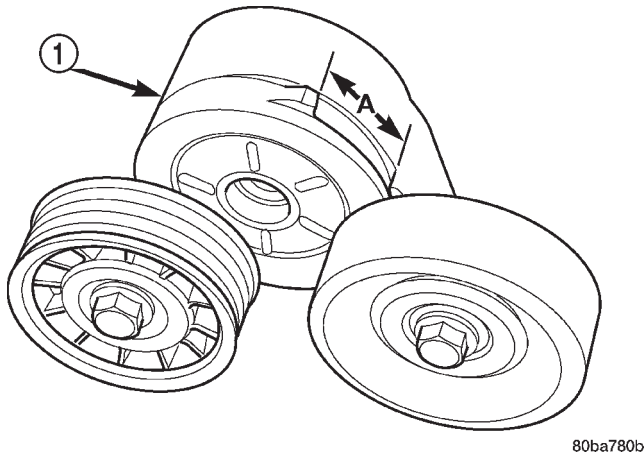


Fig. 74 Accessory Drive Belt Wear Indicator—4.7L Engine

1 – AUTOMATIC TENSIONER ASSEMBLY

ACCESSORY DRIVE BELT—3.9L/5.9L ENGINES

REMOVAL

Drive belts on both 3.9L and 5.9L engines are equipped with a spring loaded automatic belt tensioner (Fig. 75). This belt tensioner will be used on all belt configurations, such as with or without power steering or air conditioning. For more information, refer to Automatic Belt Tensioner—3.9/5.9L Engines, proceeding in this group.

- (1) Attach a socket/wrench to pulley mounting bolt of automatic tensioner (Fig. 75).
- (2) Rotate tensioner assembly clockwise (as viewed from front) until tension has been relieved from belt.
- (3) Remove belt from idler pulley first.
- (4) Remove belt from vehicle.

INSTALLATION

CAUTION: When installing serpentine accessory drive belt, the belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 76) for correct 3.9L/5.9L engine belt routing. The correct belt with correct length must be used.

- (1) Position drive belt over all pulleys **except** idler pulley. This pulley is located between generator and A/C compressor.
- (2) Attach a socket/wrench to pulley mounting bolt of automatic tensioner (Fig. 75).
- (3) Rotate socket/wrench clockwise. Place belt over idler pulley. Let tensioner rotate back into place. Remove wrench. Be sure belt is properly seated on all pulleys.

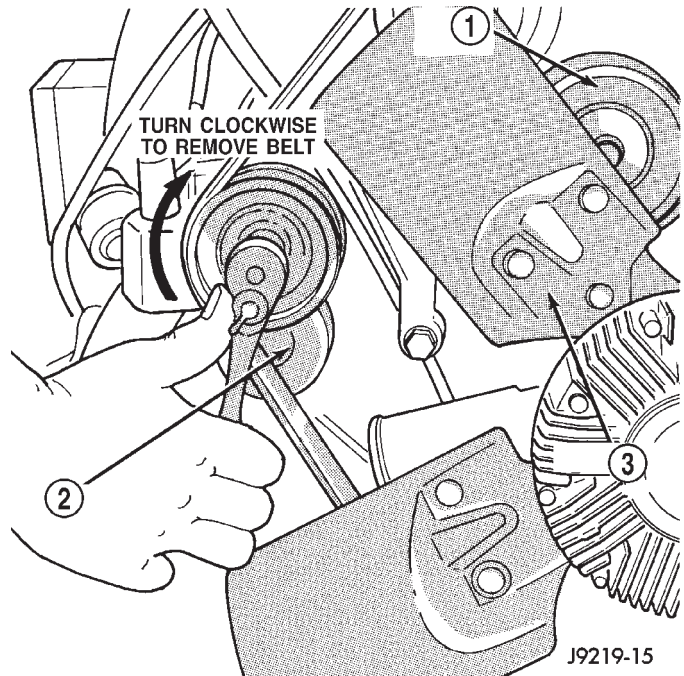


Fig. 75 Automatic Belt Tensioner—Belt Removal/Installation

- 1 – IDLER PULLEY
- 2 – TENSIONER
- 3 – FAN BLADE

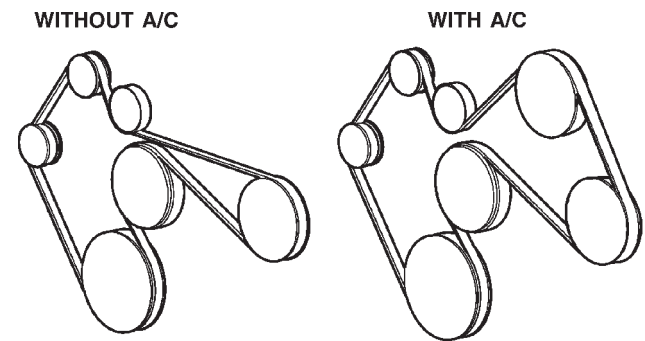


Fig. 76 Belt Routing—3.9L/5.9L Engine

- (4) Check belt indexing marks. Refer to the proceeding Automatic Belt Tensioner—3.9L/5.9L Engine for more belt information.

The tensioner is equipped with an indexing arrow on back of tensioner and an indexing mark on tensioner housing. If a new belt is being installed, arrow must be within approximately 3 mm (1/8 in.) of indexing mark. Belt is considered new if it has been used 15 minutes or less. If this specification cannot be met, check for:

- The wrong belt being installed (incorrect length/width)
- Worn bearings on an engine accessory (A/C compressor, power steering pump, water pump, idler pulley or generator)

REMOVAL AND INSTALLATION (Continued)

- A pulley on an engine accessory being loose
- Misalignment of an engine accessory
- Belt incorrectly routed. Refer to (Fig. 76)

A used belt should be replaced if tensioner indexing arrow has moved beyond the minimum tension mark.

ACCESSORY DRIVE BELT TENSIONER—2.5L

REMOVAL

- (1) Remove accessory drive belt. Refer to procedure in this section.
- (2) Remove the pulley bolt, bushing, pulley and spacer.
- (3) Remove the tensioner adjustment bolt and tensioner collar.

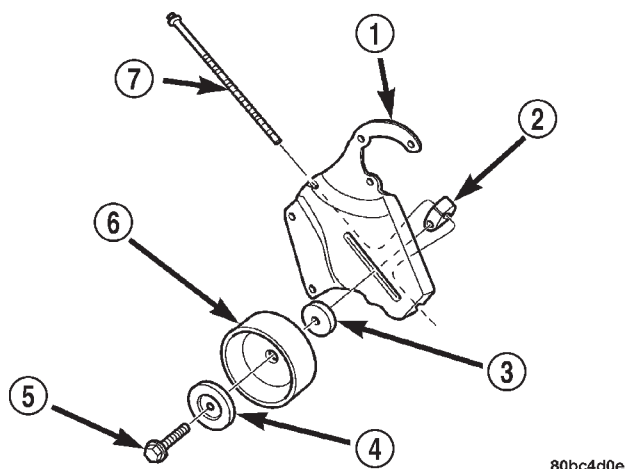


Fig. 77 Accessory Drive Belt Tensioner—2.5L Engine

- 1 - TENSIONER BRACKET
- 2 - TENSIONER COLLAR
- 3 - SPACER
- 4 - BUSHING
- 5 - BOLT
- 6 - IDLER PULLEY
- 7 - TENSIONER ADJUSTMENT BOLT

INSTALLATION

- (1) Position tensioner collar and install the tensioner adjustment bolt.
- (2) Position the spacer, idler pulley, bushing and bolt.
- (3) Install the accessory drive belt.

AUTOMATIC BELT TENSIONER 3.9L/5.9L ENGINES

REMOVAL

- (1) Attach a socket/wrench to mounting bolt of automatic tensioner pulley bolt (Fig. 75).

- (2) Rotate tensioner assembly clockwise (as viewed from front) until tension has been relieved from belt.
- (3) Remove belt from idler pulley first.
- (4) Remove belt from other pulleys.
- (5) Disconnect wiring and secondary cable from ignition coil.
- (6) Remove two mounting bolts and ignition coil from engine (Fig. 78).
- (7) Remove mounting bolt and tensioner assembly from engine (Fig. 78).

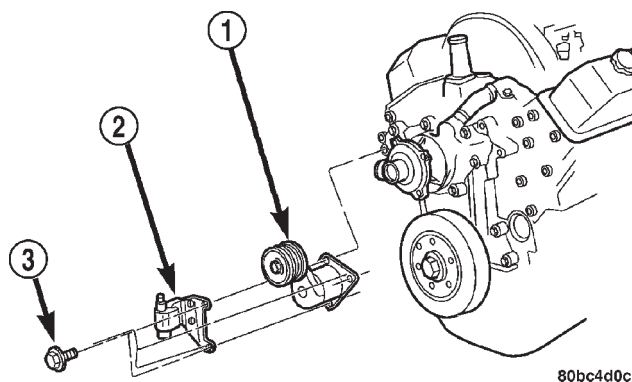


Fig. 78 Automatic Belt Tensioner Removal/Installation 3.9L/5.9L Engines

- 1 - AUTOMATIC TENSIONER
- 2 - COIL AND BRACKET
- 3 - SCREW AND WASHER

WARNING: BECAUSE OF HIGH SPRING PRESSURE, DO NOT ATTEMPT TO DISASSEMBLE AUTOMATIC TENSIONER. UNIT IS SERVICED AS AN ASSEMBLY (EXCEPT FOR PULLEY).

- (8) Remove pulley bolt. Remove pulley from tensioner.

INSTALLATION

- (1) Install pulley and pulley bolt to tensioner. Tighten bolt to 61 N·m (45 ft. lbs.).
- (2) Position tensioner assembly and install mounting screw tighten screw to 67 N·m (50 ft. lbs.).
- (3) Connect all wiring to ignition coil.
- (4) Position coil to tensioner assembly, install two mounting screws. Tighten to 11 N·m (100 in. lbs.) (Fig. 78).

CAUTION: To prevent damage to coil case, coil mounting bolts must be torqued.

- (5) Position drive belt over all pulleys **except** idler pulley (located between generator and A/C compressor).

REMOVAL AND INSTALLATION (Continued)

CAUTION: When installing serpentine accessory drive belt, the belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 76) for correct 3.9L/5.9L engine belt routing. The correct belt with correct length must be used

(6) Attach a socket/wrench to pulley mounting bolt of automatic tensioner (Fig. 75).

(7) Rotate socket/wrench clockwise. Place belt over idler pulley. Let tensioner rotate back into place. Remove wrench. Be sure belt is properly seated on all pulleys.

(8) Check belt indexing marks.

AUTOMATIC BELT TENSIONER—4.7L ENGINE

On 4.7L engines, the tensioner is equipped with an indexing tang on back of tensioner and an indexing stop on tensioner housing. If a new belt is being installed, tang must be within approximately 24 mm (.94 inches) of indexing stop. Belt is considered new if it has been used 15 minutes or less.

If the above specification cannot be met, check for:

- The wrong belt being installed (incorrect length/width)
- Worn bearings on an engine accessory (A/C compressor, power steering pump, water pump, idler pulley or generator)
- A pulley on an engine accessory being loose
- Misalignment of an engine accessory
- Belt incorrectly routed.

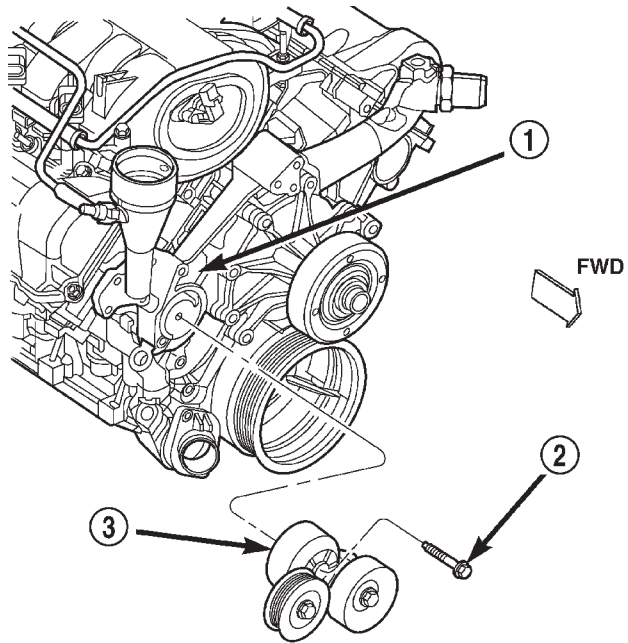
NOTE: A used belt should be replaced if tensioner indexing arrow has moved to the minimum tension indicator. Tensioner travel stops at this point.

REMOVAL

- (1) Remove accessory drive belt. Refer to Accessory Drive Belt in this section.
- (2) Remove tensioner assembly from mounting bracket (Fig. 79).

WARNING: BECAUSE OF HIGH SPRING PRESSURE, DO NOT ATTEMPT TO DISASSEMBLE AUTOMATIC TENSIONER. UNIT IS SERVICED AS AN ASSEMBLY EXCEPT FOR PULLEY ON TENSIONER.

- (3) Remove pulley bolt. Remove pulley from tensioner.



80b898fb

Fig. 79 Automatic Belt Tensioner—4.7L Engine

- 1 – TIMING CHAIN COVER
- 2 – BOLT TORQUE TO 41 N·m (30 FT LBS)
- 3 – AUTOMATIC BELT TENSIONER

INSTALLATION

- (1) Install pulley and pulley bolt to tensioner. Tighten bolt to 61 N·m (45 ft. lbs.) torque.
- (2) An indexing slot is located on back of tensioner. Align this slot to the head of the bolt on the front cover. Install the mounting bolt. Tighten bolt to 41 N·m (30 ft. lbs.).
- (3) Install accessory drive belt.
- (4) Check belt indexing marks.

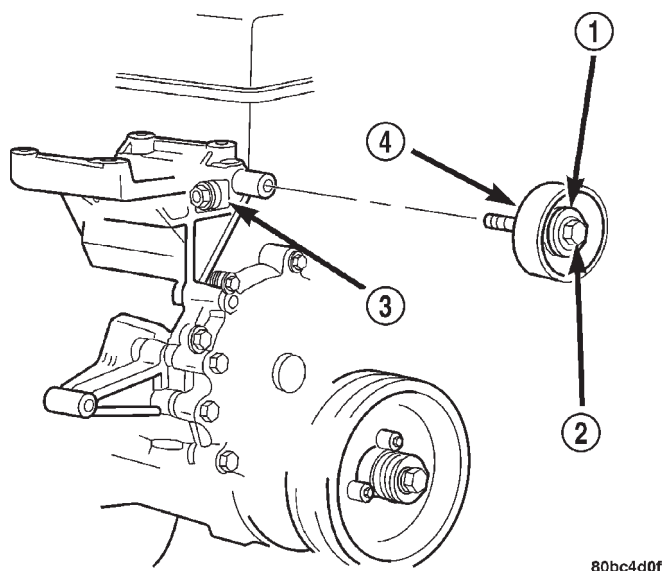
IDLER PULLEY—2.5L/3.9L/5.9L ENGINES**REMOVAL**

- (1) Remove the accessory drive belt. Refer to Accessory Drive Belt in this section.
- (2) Remove the screw and washer, pulley bushing and idler pulley from the mounting bracket (Fig. 80) (Fig. 81).

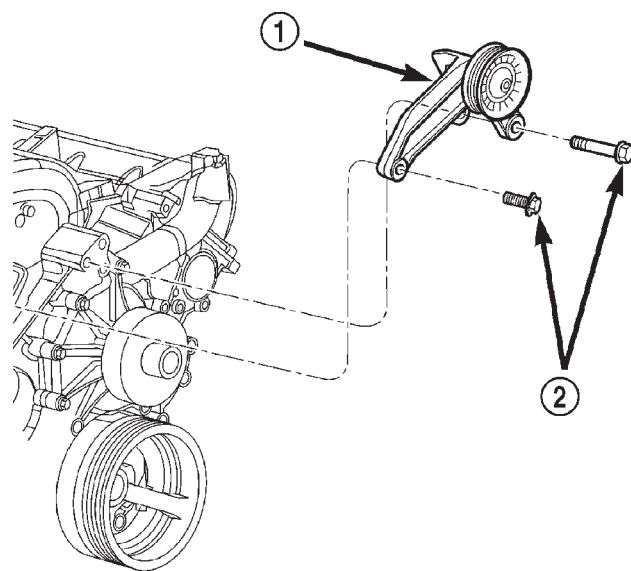
INSTALLATION

- (1) Position the idler pulley and bushing onto the mounting bracket.
- (2) Install the idler pulley mounting bolt, tighten bolt to 57 N·m (42 ft. lbs.).
- (3) Install the accessory drive belt.

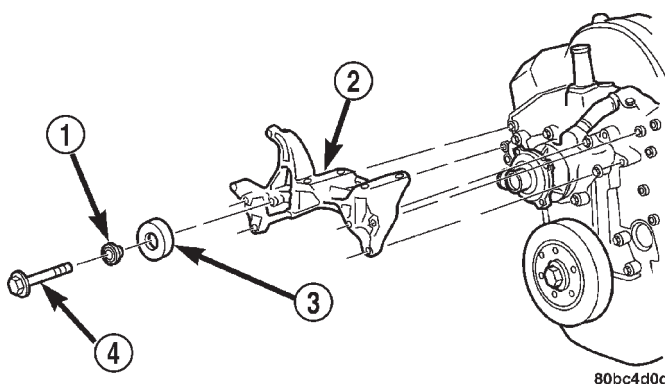
REMOVAL AND INSTALLATION (Continued)

**Fig. 80 Idler Pulley 2.5L Engine**

- 1 - BUSHING
- 2 - SCREW AND WASHER
- 3 - A/C AND GENERATOR MOUNTING BRACKET
- 4 - IDLER PULLEY

**Fig. 82 Idler Pulley Removal and Installation**

- 1 - IDLER PULLEY AND BRACKET
- 2 - BOLT (2)

**Fig. 81 Idler Pulley 3.9L and 5.9L Engines**

- 1 - IDLER PULLEY BUSHING
- 2 - A/C AND/OR GENERATOR MOUNTING BRACKET
- 3 - IDLER PULLEY
- 4 - SCREW AND WASHER

IDLER PULLEY—4.7L ENGINE NON A/C**REMOVAL**

- (1) Disconnect the negative battery cable from battery.
- (2) Remove the accessory drive belt. Refer to procedure in this section.
- (3) Remove the two bolts retaining the idler pulley assembly to the engine (Fig. 82).

INSTALLATION

- (1) Position the idler pulley assembly onto the engine and install the two retaining bolts. Tighten the bolts to 55 N·m (40 ft. lbs.).
- (2) Install the accessory drive belt.
- (3) Connect the negative battery cable.

RADIATOR DRAINCOCK**REMOVAL**

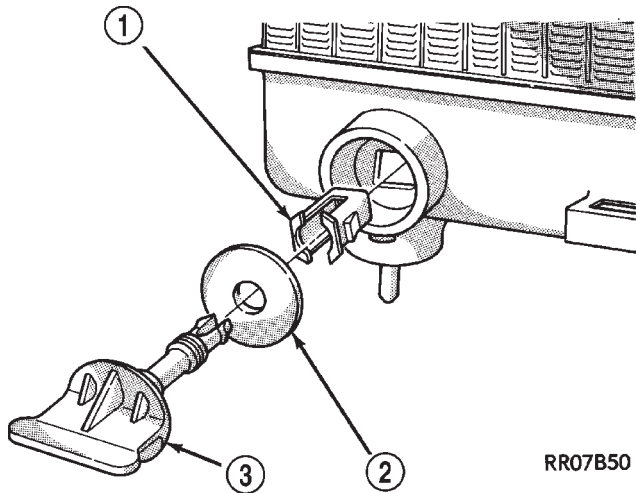
WARNING: DO NOT LOOSEN RADIATOR DRAINCOCK WITH SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM COOLANT CAN OCCUR.

- (1) Unscrew draincock stem (counterclockwise rotation). When stem is completely unscrewed, pull it from radiator tank and draincock body (Fig. 83).
- (2) Using a pair of needle nose pliers, compress draincock body and pull straight out of radiator (Fig. 84).

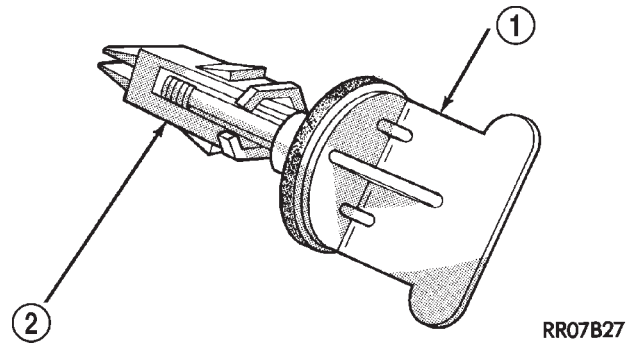
INSTALLATION

- (1) Install draincock stem loosely into body (Fig. 85). The draincock assembly cannot be installed if stem is threaded into the body.
- (2) Push draincock assembly into opening in radiator tank. It will snap into place when fully seated.
- (3) Tighten draincock (clockwise) to 2.0 to 2.7 N·m (18-25 in. lbs.) torque.

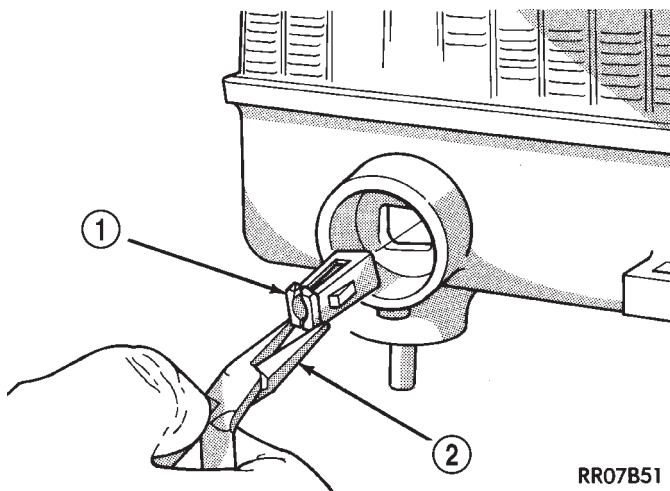
REMOVAL AND INSTALLATION (Continued)

**Fig. 83 Draincock Assembly**

- 1 - BODY
- 2 - SEAL
- 3 - STEM

**Fig. 85 Draincock Assembled for Installation**

- 1 - STEM
- 2 - BODY LOOSE ON STEM

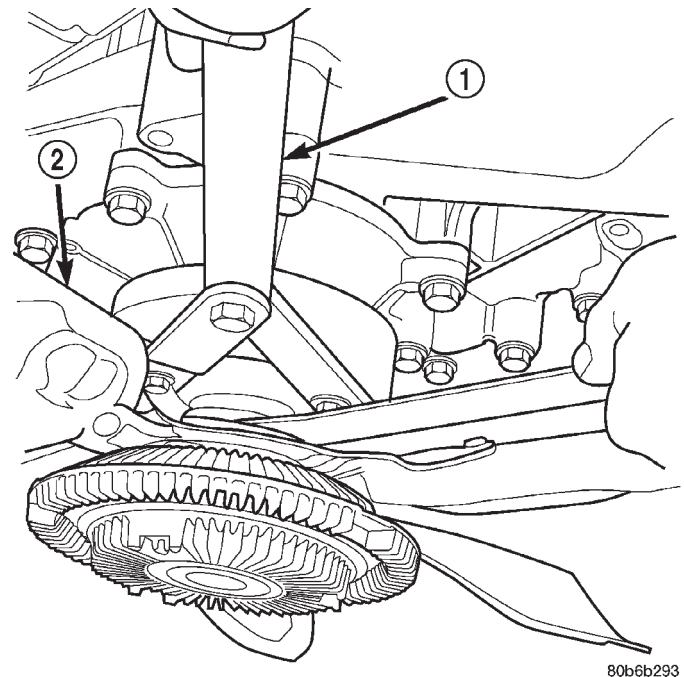
**Fig. 84 Draincock Body Removal**

- 1 - DRAINCOCK BODY
- 2 - NEEDLE NOSE PLIERS

VISCIOUS FAN DRIVE

REMOVAL

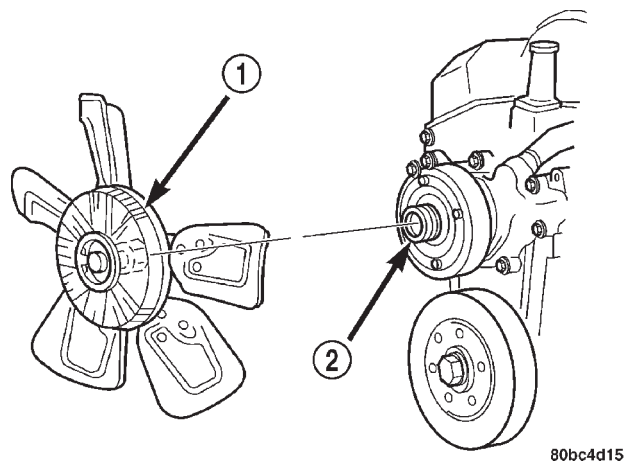
- (1) Disconnect battery negative cable.
- (2) The thermal viscous fan drive/fan blade assembly is attached (threaded) to water pump hub shaft (Fig. 87). Remove fan blade/viscous fan drive assembly from water pump by turning mounting nut counterclockwise as viewed from front. Threads on viscous fan drive are **RIGHT HAND**. A Snap-On 36 MM Fan Wrench (number SP346 from Snap-On Cummins Diesel Tool Set number 2017DSP) and Special Tool 6958 Spanner Wrench with Adapter Pins 8346

**Fig. 86 Fan Blade and Viscous Fan Drive Removal**

- 1 - SPECIAL TOOL 6958 SPANNER WRENCH WITH ADAPTER PINS 8346
- 2 - FAN

- (4) Do not unbolt fan blade assembly (Fig. 88) from viscous fan drive at this time.
- (5) Remove upper fan shroud attaching hardware (Fig. 89).
- (6) Remove upper fan shroud and fan blade/viscous fan drive from vehicle.
- (7) After removing fan blade/viscous fan drive assembly, **do not** place viscous fan drive in horizontal position. If stored horizontally, silicone fluid in

REMOVAL AND INSTALLATION (Continued)

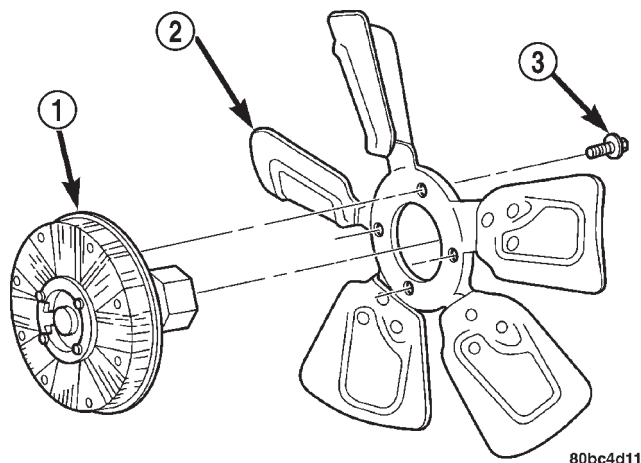
**Fig. 87 Fan Blade/Viscous Fan Drive**

- 1 - FAN AND VISCOUS DRIVE
2 - WATER PUMP THREADED SHAFT

the viscous fan drive could drain into its bearing assembly and contaminate lubricant.

CAUTION: Do not remove water pump pulley-to-water pump bolts (Fig. 87). This pulley is under spring tension.

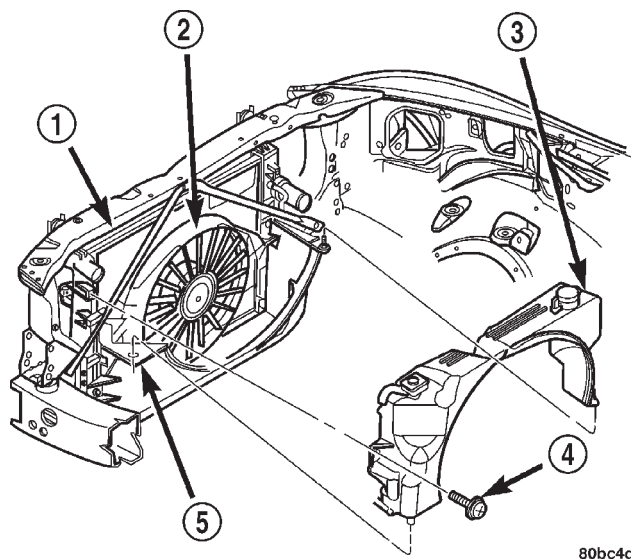
(8) Remove four bolts securing fan blade assembly to viscous fan drive (Fig. 88).

**Fig. 88 Viscous Fan Drive and Fan Blade**

- 1 - VISCOUS FAN DRIVE
2 - FAN BLADE
3 - SCREW AND WASHER

INSTALLATION

- (1) Install fan blade assembly to viscous fan drive. Tighten bolts (Fig. 88) to 23 N·m (17 ft. lbs.) torque.
- (2) Position fan blade/viscous fan drive assembly and upper shroud into vehicle.
- (3) Install fan shroud retaining screws (Fig. 89).

**Fig. 89 Upper Fan Shroud Removal/Installation**

- 1 - RADIATOR
2 - ELECTRIC COOLING FAN
3 - UPPER SHROUD AND OVERFLOW BOTTLE
4 - SCREW
5 - LOWER SHROUD

- (4) Install fan blade/viscous fan drive assembly to water pump shaft (Fig. 87).
- (5) Connect battery negative cable.

ELECTRIC FAN**REMOVAL**

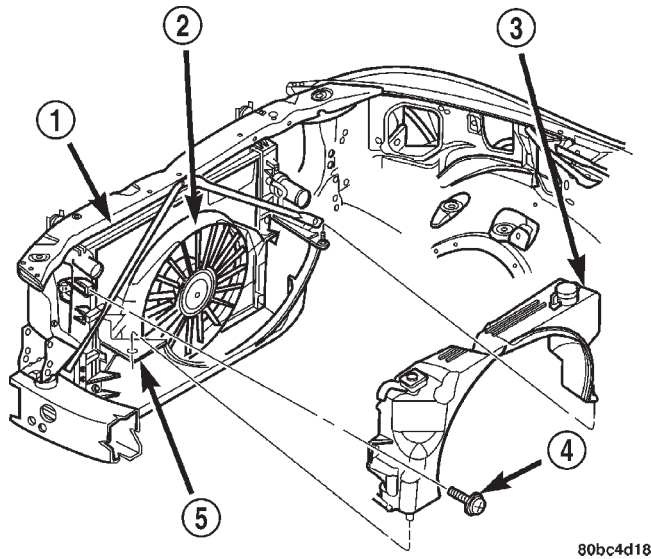
If the fan blade is bent, warped, cracked or damaged in any way, it must be replaced **only** with a replacement fan blade. **Do not attempt to repair a damaged fan blade.**

- (1) Disconnect battery negative cable.
- (2) Disconnect fan motor wire connector.
- (3) Remove the two fan shroud mounting clips connecting the upper part of fan shroud to the radiator (Fig. 90).
- (4) Remove fan assembly from radiator.

INSTALLATION

- (1) Install fan assembly onto the radiator. Tighten bolts 5 N·m (45 in. lbs.).
- (2) Connect fan motor wire connector to harness connector.
- (3) Connect battery negative cable.
- (4) Start engine and check fan operation.

REMOVAL AND INSTALLATION (Continued)

**Fig. 90 Fan Shroud—Typical**

- 1 - RADIATOR
- 2 - ELECTRIC COOLING FAN
- 3 - UPPER SHROUD AND OVERFLOW BOTTLE
- 4 - SCREW
- 5 - LOWER SHROUD

80bc4d18

CLEANING AND INSPECTION

RADIATOR CAP

CLEANING

Use only a mild soap and water to clean the radiator cap. Using any type solvent may cause damage to the seal in the radiator cap.

INSPECTION

Hold cap at eye level, right side up. The vent valve (Fig. 29) at bottom of cap should open. If rubber gasket has swollen and prevents vent valve from opening, replace cap.

Hold cap at eye level, upside down. If any light can be seen between vent valve and rubber gasket, replace cap. **Do not use a replacement cap that has a spring to hold vent shut.** A replacement cap must be the type designed for a coolant reserve/overflow system with a completely sealed diaphragm spring and a rubber gasket. This gasket is used to seal to radiator filler neck top surface. Use of proper cap will allow coolant return to radiator.

RADIATOR

CLEANING

Clean radiator fins With the engine cold, apply cold water and compressed air to the back (engine side) of

the radiator to flush the radiator and/or A/C condenser of debris.

INSPECTION

The radiator cooling fins should be checked for damage or deterioration. Inspect cooling fins to make sure they are not bent or crushed, these areas result in reduced heat exchange causing the cooling system to operate at higher temperatures. Inspect the plastic end tanks for cracks, damage or leaks.

Inspect the radiator neck for damage or distortion.

WATER PUMP

CLEANING

Clean the gasket mating surface. Use caution not to damage the gasket sealing surface.

INSPECTION

Inspect the water pump assembly for cracks in the housing, Water leaks from shaft seal, Loose or rough turning bearing or Impeller rubbing either the pump body or timing chain case/cover.

FAN BLADE

CLEANING

Clean the fan blades using a mild soap and water. Do not use an abrasive to clean the blades.

INSPECTION

WARNING: DO NOT ATTEMPT TO BEND OR STRAIGHTEN FAN BLADES IF FAN IS NOT WITHIN SPECIFICATIONS.

CAUTION: If fan blade assembly is replaced because of mechanical damage, water pump and viscous fan drive should also be inspected. These components could have been damaged due to excessive vibration.

(1) Remove fan blade assembly from viscous fan drive unit (four bolts).

(2) Lay fan on a flat surface with leading edge facing down. With tip of blade touching flat surface, replace fan if clearance between opposite blade and surface is greater than 2.0 mm (.090 inch). Rocking motion of opposite blades should not exceed 2.0 mm (.090 inch). Test all blades in this manner.

(3) Inspect fan assembly for cracks, bends, loose rivets or broken welds. Replace fan if any damage is found.

SPECIFICATIONS

COOLING SYSTEM CAPACITIES

| ENGINE | CAPACITY |
|--------|--------------------|
| 2.5L | *9.3L (9.8 Qts.) |
| 3.9L | *13.3L (14.0 Qts) |
| 4.7L | *12.3L (13.0 Qts.) |
| 5.9L | *13.7L (14.6 Qts) |

* Nominal refill capacities are shown. A variation may be observed from vehicle due to manufacturing tolerances and refill procedures.

* Capacities shown include vehicles with air conditioning and/or heavy duty cooling systems.

ACCESSORY DRIVE BELT TENSION—2.5L ENGINE

| BELT | TENSION |
|--|--------------------------|
| **NEW SERPENTINE BELT | 800-900 N (180-200 lbs.) |
| USED SERPENTINE BELT | 623-712 N (140-160 lbs.) |
| **Belt is considered new if it has been used 15 minutes or less. | |
| Specifications for use with a belt tension gauge. Refer to operating instructions supplied with gauge. | |

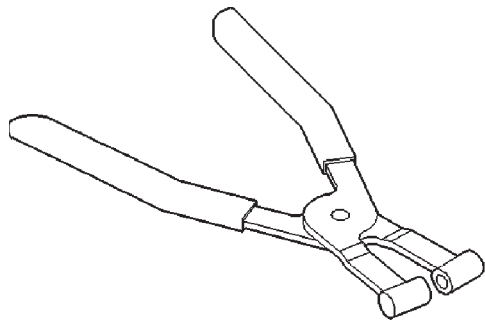
NOTE: Do not attempt to check belt tension on vehicles equipped with the 3.9L/4.7L/5.9L engines. They are equipped with an automatic belt tensioner.

TORQUE SPECIFICATIONS

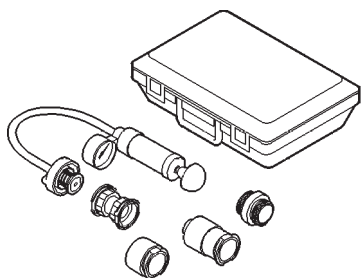
| DESCRIPTION | N-m | Ft. Lbs. | In. Lbs. |
|--|-----|-------------|-------------|
| Automatic Belt Tensioner to Mounting Bracket Bolts (3.9L/5.9L) | 67 | 50 | — |
| Automatic Belt Tensioner to Block Bolts (3.9L/4.7L/5.9L) | 41 | 30 | — |
| Automatic Belt Tensioner Pulley Bolt (3.9L/4.7L/5.9L) | 61 | 45 | — |
| Belt Tensioner Bracket to Block Bolts (2.5L) | 47 | 35 | — |
| Belt Idler Pulley Fixed Pulley Bolt (2.5L) | 57 | 42 | — |
| Belt Tensioner Pulley Bolt (2.5L) | 57 | 42 | — |
| Block Heater Bolt (2.5L) | 4 | — | 32 |
| Block Heater Bolt (3.9L/4.7L/5.9L) | 2 | — | 17 |
| Radiator to Support Bolts | 23 | — | 200 |
| Thermostat Housing Bolts (2.5L) | 22 | 16 | — |
| Thermostat Housing Bolts (3.9L/5.9L) | 22 | 16 | — |
| Thermostat Housing Bolts (4.7L) | 13 | — | 115 |
| Transmission Auxiliary Oil Cooler Bolts | 10 | — | 90 |
| Upper Radiator Closure Panel Bolts | 10 | — | 90 |
| Water Pump Bolts (2.5L) | 30 | 22 | — |
| Water Pump Bolts (3.9L/5.9L) | 40 | 30 | — |
| Water Pump Bolts (4.7L) | 54 | 40 | — |
| Fan Shroud Bolts | 6 | — | 50 |
| Electric Fan to Radiator Bolts | 5 | — | 45 |

SPECIAL TOOLS

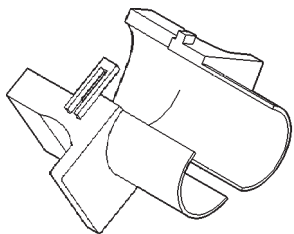
COOLING



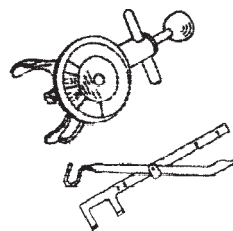
Pliers Constant Pressure Hose Clamp—6094



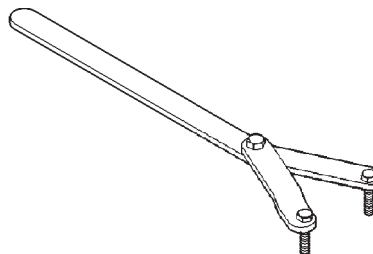
Pressure Tester—7700A



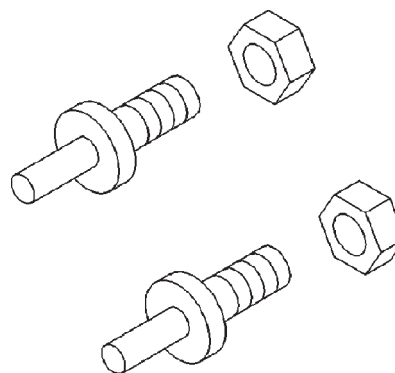
3/8" Disconnect Tool—6935



Belt Tension Gauge —C4162



Spanner Wrench 6958



Adapter Pins 8346

